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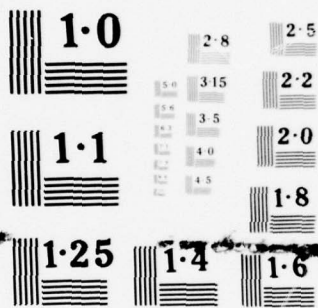
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**Army Appropriation FY 1978**

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Department of the Army  
Deputy Chief of Staff for Research, Development, and Acquisition

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## FOREWORD

These volumes have been prepared to provide information on the US Army Research, Development, Test, and Evaluation Program for Congressional Committees during the Fiscal Year 1978 hearings. This information is in addition to the testimony given by US Army witnesses.

These volumes contain a descriptive summary for each program element to be financed during FY 1978 or FY 1979. Descriptive summaries for projects within the program elements to be financed during FY 1978 or FY 1979 for \$3.0 million or more appear on buff colored pages immediately following the applicable program element. Where there are several items under development within a project, a separate summary has been provided for each item that exceeds \$3.0 million during FY 1978 or FY 1979. A Test and Evaluation Section is provided for all major weapon systems.

There are thirty-nine major weapon systems descriptive summaries appearing in Volumes II and III. Major weapon systems are identified by an asterisk in the Table of Contents. The formats and contents of these volumes are in accordance with guidelines and requirements of the Congressional Committees insofar as possible. Information previously provided in the SAC Data Book is consolidated into these volumes. The SAC Data Book information appears at the beginning of each program element descriptive summary.

A direct comparison of FY 1976, FY 1977, and FY 1978 data in this Program Element Listing with data shown in the Program Element Listing dated January 1976 will reveal significant differences. Many of the differences are attributable to the following factors:

a. A FY 1976 increase of \$4.691 million representing additional recoupments from RDTE surcharges on Foreign Military Sales and transfer of reimbursements from prior years.

b. A FY 1977 net reduction of \$81.1 million resulting from the following:

- |   |   |                 |
|---|---|-----------------|
| (1) Congressional reduction                       | - | \$-95.5 million |
| (2) Proposed supplemental for civilian pay raises | - | +14.4 million   |

c. Reclassification to provide greater visibility and contribute to the effective management of the RDTE program such as the following:

- (1) The Medical RDTE Program
- (2) Combat Support Munitions
- (3) Field Artillery Weapons Ammunition Development
- (4) Mobility Equipment Technology
- (5) Further extension of the Single Program Element Funding Concept.



d. Restructuring of the FY 1976, FY 1977, and FY 1978 programs for comparability to the FY 1978 program structure.

e. Planned RDTE effort to be accomplished at installations operating under the Army Industrial Fund (AIF) will require supplemental funds to cover civilian pay raises included in AIF stabilized rates.

The funding information used in these volumes corresponds to that contained in the President's Budget. Procurement data is shown where applicable for items in engineering or operational development. Military construction data is shown where applicable.

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| *6.37.46.A | SINGLE CHANNEL GROUND AND AIRBORNE RADIO SUBSYSTEM (SINGARS-V) | 683 |
| 6.42.01.A  | AIRCRAFT AVIONICS  | 688 |
| DC96       | AIRCRAFT NAVIGATION AND CONTROL SYSTEMS                        | 691 |
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| *6.42.02.A | AIRCRAFT WEAPONS   | 695 |
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| D378       | UTILITY TACTICAL TRANSPORT AIRCRAFT SYSTEM (UTTAS)             | 720 |
| *6.42.07.A | ADVANCED ATTACK HELICOPTER (AAH)                               | 724 |
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| DV02      | TEST BOARDS  | 1103 |
| DW03      | INITIAL OPERATIONAL TEST AND EVALUATION (IOTE)                           | 1106 |
| D986      | SUPPORT EQUIPMENT  | 1108 |
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| DE90      | MATERIEL DEVELOPMENT AND READINESS COMMAND (DARCOM)                      | 1143 |
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| DE93      | DUGWAY PROVING GROUND  | 1155 |
| DE94      | WHITE SANDS MISSILE RANGE  | 1159 |
| DE95      | US ARMY ELECTRONIC PROVING GROUND  | 1163 |
|           | COLD REGIONS TEST CENTER   |      |

# GLOSSARY

## PROGRAM ABBREVIATIONS, ACRONYMS, AND POPULAR NAMES

| TERM                    | EXPLANATION   | PROGRAM ELEMENT / PROJECT | PAGE NO. |
|-------------------------|---|---------------------------|----------|
| AAH                     | Advanced Attack Helicopter                            | 6.42.07.A                 | 724      |
| AFAADS                  | Advanced Forward Area Air Defense System              | 6.33.01.A                 | 562      |
| AMIM                    | Advanced Multipurpose Missile System                  | 6.36.12.A                 | 587      |
| AN/TPQ-37               | Artillery Locating Radar                              | 6.47.31.A                 | 984      |
| ARTADS                  | Army Tactical Data Systems                            | 6.37.23.A                 | 399      |
| BMDSTP                  | Ballistic Missile Defense Systems Technology Program  | 6.33.08.A                 | 450      |
| BUSHMASTER (also VRFWS) | Vehicle Rapid Fire Weapon System                      | 6.46.17.A                 | 858      |
| CAAM                    | Conventional Airfield Attack Missile                  | 6.33.19.A                 | 584      |
| CEFIRE TIGER            | Airborne Electronic Countermeasure System AN/ALO-150  | 6.47.11.A D906-55         | 922      |
| CHAPARRAL               | Low Altitude Air Defense System                       | 2.37.30.A                 | 482      |
| COMSEC                  | Communications Security Equipment                     | 3.34.01.A                 | 1040     |
| COPPERHEAD              | Cannon Launched Guided Projectile                     | 6.46.21.A                 | 877      |
| CSTA                    | Combat Surveillance, Target Acquisition               | 6.27.03.A                 | 137      |
| DARPA                   | Defense Advanced Research Project Agency              | 6.27.06.A                 | 206      |
| DRAGON                  | Medium Antitank Assault Weapon                        | 2.37.27.A                 | 473      |
| DSCS                    | Defense Satellite Communications System               | 3.31.42.A D253            | 545      |
| EW                      | Electronic Warfare                                    | 6.27.15.A                 | 160      |
|                         |   | 6.37.11.A                 | 623      |
|                         |   | 6.47.11.A                 | 922      |
|                         |   | 6.47.28.A                 | 974      |
| FAMECE                  | Family of Military Engineering Construction Equipment | 2.37.31.A                 | 492      |
| HAWK/HIP                | Surface-to-Air Missile (Improved)                     | 6.33.14.A                 | 325      |
| HEL                     | High Energy Laser Components                          | 6.43.10.A                 | 781      |
| HELLFIRE                | Heliborne Missile, Laser Guided                       | 6.37.06.A                 | 384      |
| IFF                     | Identification Friend or Foe                          | 6.46.23.A                 | 883      |
| ILAW                    | Improved Light Antitank Weapon                        | 6.11.01.A                 | 1        |
| ILIR                    | In-House Laboratory Independent Research              | 6.37.07.A D137            | 619      |
| JTIDS                   | Joint Tactical Information Distribution System        | 6.53.01.A                 | 1070     |
| KMR                     | Kwajalein Missile Range                               | 2.37.33.A                 | 507      |
| LANCE                   | Surface to Surface Ballistic Missile System           | 6.46.16.A                 | 851      |
| MICV                    | Mechanized Infantry Combat Vehicle                    | 2.37.35.A                 | 519      |
| M60A1 PIP               | M60A1 Tank Product Improvement Program                | 6.27.27.A                 | 209      |
| NSTD                    | Non-Systems Training Devices Technology               |                           |          |

| TERM                    | EXPLANATION   | PROGRAM ELEMENT / PROJECT | PAGE NO. |
|-------------------------|---|---------------------------|----------|
| OTEA                    | Operational Test and Evaluation Agency  | 6.57.12.A                 | 1117     |
| PERSHING II             | Surface-to-Surface Nuclear Missile  | 6.33.11.A                 | 571      |
| REMBASS                 | Remotely Monitored Battlefield Sensor System                                    | 6.37.04.A DK73            | 609      |
| RFV                     | Remotely Piloted Vehicles and Drones  | 6.27.32.A                 | 218      |
|                         |   | 6.37.25.A                 | 402      |
| SAM-D                   | Surface-to-Air Missile Development  | 6.43.07.A                 | 760      |
| SFTS                    | Synthetic Flight Training System  | 6.42.04.A D275            | 704      |
| SHE TMA                 | Super High Frequency Time Division Multiple Access                              | 2.80.10.A D113            | 538      |
| SOTAS                   | Stand-Off Target Acquisition System   | 6.47.48.A                 | 1024     |
| STINGER                 | Shoulder Fired, Forward Area Air Defense Missile                                | 6.43.06.A                 | 733      |
| TACTIRE                 | Tactical Fire Direction System  | 2.37.26.A                 | 465      |
| TIME                    | Test Measurement and Diagnostic Equipment                                       | 6.27.79.A                 | 272      |
| TOS                     | Tactical Operations System  | 6.37.22.A                 | 690      |
| TOW                     | Tube Launched, Optically Tracked, Wire Guided (Heavy) Antitank Assault Weapon   | 2.37.24.A                 | 457      |
| TRADOC                  | Training and Doctrine Command   | 6.51.02.A                 | 1056     |
| TRI-TAC                 | Tri-Service Tactical Communications Program                                     | 2.80.10.A                 | 524      |
| UGS                     | Unattended Ground Sensors   | 6.47.04.A                 | 905      |
| UTIAS                   | Utility Tactical Transport Aircraft System (Infantry Squad Carrying Helicopter) | 6.42.06.A                 | 711      |
| VRFWS (also BUSHMASTER) | Vehicle Rapid Fire Weapon System  | 6.46.17.A                 | 858      |
| VTOL                    | Vertical Take-Off and Landing   | 6.32.11.A                 | 303      |
| VULCAN                  | Air Defense Gun Systems   | 2.37.32.A                 | 502      |
| WMCCS                   | Worldwide Military Command and Control Systems                                  | 6.37.35.A                 | 453      |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.33.04.A

Title Ballistic Missile Defense Advanced Technology Program

Category Advanced Development

Budget Activity #3 - Strategic Programs

RESOURCES [PROJECT LISTINGS]: (\$ in Thousands)

| Project Number | Title  | FY 1976<br>97000 | FY 1977<br>25158 | FY 1978<br>107297 | FY 1979<br>121519 | Additional<br>to<br>Completion<br>Continuing | Total<br>Estimated<br>Cost<br>Not Applicable |
|----------------|--|------------------|------------------|-------------------|-------------------|--|--|
| D215           | Ballistic Missile Defense<br>Advanced Technology Program | 97000            | 25158            | 107297            | 121519            | Continuing                                   | Not Applicable                               |

**BRIEF DESCRIPTION OF ELEMENT:** The BMD Advanced Technology Program provides the research necessary to the understanding of new technologies and their application to the performance of complex BMD functions. Major efforts are directed toward the development of advanced BMD technologies and a wide ranging search for revolutionary new concepts and ideas which could yield fundamental breakthroughs in BMD capability.

**BASIS FOR FY 1978 RDTE REQUEST:** Develop advanced techniques to identify threatening targets in a cluttered environment. Refine and evaluate advanced software development methodologies. Verify simulation models and qualify flight weight guidance hardware in the exoatmospheric interceptor ground test program. Conduct an initial flight test of a rocket-borne optical sensor to gather signature data on reentry complexes. Procure an intelligence collection radar system in conjunction with the Air Force. Investigate new concepts and technologies and conduct laboratory experiments on advanced weapons concepts.

**BASIS FOR INCREASE IN FY 1978 OVER FY 1977:** The increase allows for inflationary increases and for modest increases in development of new concepts and technologies.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement) is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 159  | 0           | 159   |
| (2) Contractor Employees   | 2262 | 0           | 2262  |
| Total                      | 2421 | 0           | 2421  |

Budget Activity #3 - Strategic Programs

Program Element #6.33.04.A Title Ballistic Missile Defense Advanced Technology Program

DETAILED BACKGROUND AND DESCRIPTION: The BMD Advanced Technology Program is a vigorous, broad research effort on the technology of all BMD components and functions including reentry phenomenology, computers, advanced interceptor missiles, optical and radar sensors and the continuing assessment of new technologies. The objectives of this program are to: Provide the advanced technological foundation for future BMD systems concepts, emphasizing approaches which could yield fundamental breakthroughs in BMD capability; provide the technological basis for substantial improvements in nearer-term BMD systems; avoid technological surprise by Soviet BMD developments; and assist in the design and evaluation of US strategic offensive systems by continuing exchange of information on their penetrability and by technological assessments of future Soviet BMD capability.

RELATED ACTIVITIES: Related activities include testing at Kwajalein Missile Range, 6.53.01.A; and BMD Systems Technology, 6.33.08.A.

WORK PERFORMED BY: The ten major contractors for FY 78 are expected to be: Massachusetts Institute of Technology (Lincoln Laboratory), Lexington, MA; System Development Corporation, Santa Monica, CA; General Motors Corp., Goleta, CA; Rockwell International Corp., Anaheim, CA; McDonnell Douglas Corporation, Huntington Beach, CA; Aeronutronic Ford Corp., Newport Beach, CA; TRW, Redondo Beach, CA; Brown Engineering Company, Huntsville, AL; Boeing Co., Seattle, WA; Lockheed Aircraft Corp., Palo Alto, CA. There will be approximately 40 additional prime contractors and the estimated total dollar value of these contracts is \$69.1 million. In-house developing organizations include: US Army Missile Research and Development Command, Huntsville, AL; US Army Electronics Research and Development Command, Ft Monmouth, NJ; Harry Diamond Laboratories, Adelphi, MD; Arnold Engineering Development Center, Tullahoma, TN; Ballistic Research Laboratories (US Army Armament Research and Development Command) Aberdeen, MD; Naval Electronics Laboratory Center, San Diego, CA; Corp of Engineers, Huntsville, AL; and Naval Research Laboratory, Washington, DC.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The flight program for the Special Targets Program (STP) designed to provide a data base for the development of discrimination algorithms and bulk filters for separating reentry vehicle (RVs) and traffic decoys from clutter, was completed with nine dedicated launches and two additional traffic decoys flown as auxiliary payloads. An advanced terminal interceptor program (UpSTAGE) designed to determine the feasibility of intercepting the high energy evasive maneuvering reentry vehicle (MaRV) within the terminal regime, was successfully completed. The UpSTAGE program developed and demonstrated a credible technology base (including fast burning propellants, controllable hypersonic lifting bodies, laser gyros, external burning and jet interaction controls) for a follow-on generation of terminal interceptors. Successful tests of an adaptive array technique, a method used to counter a large number of offensive electronic jammers employed against a radar, was conducted. The Fly Along Infrared (FAIR) flight experiments were completed providing exoatmospheric signatures at short ranges on operational vehicles to improve signature prediction and discrimination technology. The Signature of Fragmented Tanks (SOFT) flight program which provided radar observations at three frequencies and some optical data on a purposefully fragmented tank representing an exoatmospheric penetration aid threat was completed. The last flight of the Ballistic Missile Defense Test Program (BMDTP) was conducted in December 1975. The BMDTP, utilizing the Missile Site Radar (MSR) at Kwajalein, was a very



Budget Activity #3 - Strategic Programs

Program Element #6.33.04.A

Title Ballistic Missile Defense Advanced Technology Program

successful program conducted to gather data which characterizes the clutter effects of tank fragmentation created by the breakup of ICBM and IRBM booster tanks as they enter the atmosphere. The program used two TITANS and two THORS as dedicated targets with additional data being collected on numerous targets of opportunity. A new analog device called a memory correlator, which has both computational capability and memory, was invented by engineers at Lincoln Laboratory and experimentally tested. The device makes use of surface acoustic wave techniques which permit inexpensive, miniaturized units having a capability currently available only with much larger, more complex digital equipment. This technology could ultimately lead to better and cheaper radars, sonars, and other sensors. Installation of the Parallel Element Processing Ensemble (PEPE) at the Advanced Research Center was completed and tests have begun to demonstrate the expanded throughput capacity of this unique architecture. The PEPE uses numerous low cost mini-processors to solve BMD problems requiring the simultaneous solution of many identical problems. The Ground Based Measurements (GBM) system, an improved two-color optical instrument for use in gathering Long Wave Infrared (LWIR) data, was installed at Kwajalein and is recording radiometric data on reentering vehicles. High burn rate propellants in small scale motors were demonstrated in attempts to develop a propellant capable of driving a high performance interceptor. The Homing Interceptor Technology (HIT) vehicle has been tested in a ground based flight test chamber and all essential homing, navigation and control system functions were successfully demonstrated. HIT is a miniature homing interceptor vehicle concept designed to achieve non-nuclear kill of threatening objects in exoatmospheric scenarios. A laboratory experiment to determine the practicability of

The Designating Optical Tracker (DOT) Program, an experiment to determine the ability of an optical sensor to perform discrimination and tracking functions under realistic engagement geometry in the exoatmosphere, was initiated.

2. FY 1977 Program: Theoretical analysis, field data analysis, and laboratory measurements to develop discrimination techniques which identify threatening objects will be performed. Design of recording and transmitting equipment in support of the Boost Measurements and Analysis Program (BMAP) will be initiated. Simulation models and experiments to evaluate the application of microprocessor arrays with large mosaic optical sensors will be defined and developed. Experiments will be conducted to evaluate PEPE in advanced BMD systems constructs. Larger subscale prototype high burning rate motors will be tested to validate characteristics of advanced propulsion for a high performance terminal interceptor. An exoatmospheric interceptor ground test program employing hardware-in-the-loop techniques to both verify the simulation model and to demonstrate the capability to qualify flight weight guidance hardware for future flight test experiments will be initiated. Advanced optical sensor concepts will be developed and optical data will continue to be gathered on reentry systems at Kwajalein. The initial DOT flight tests will be conducted to provide exoatmospheric signature data on targets of opportunity at Kwajalein. Component development in digital and acoustic technology to improve radar sensor performance will continue. L-Band solid state receiver modules will be evaluated in a small array test fixture to establish reliability and performance characteristics. A laser radar will be installed at Kwajalein and the application of lasers and millimeter wave radars to BMD will continue to be investigated. Procurement of an intelligence collection radar system in conjunction with the Air Force will be initiated.

Budget Activity #3 - Strategic Programs

Program Element #6.33.04.A

Title Ballistic Missile Defense Advanced Technology Program

3. FY 1978 Planned Program: Development of a reentry data base containing data on reentry vehicles of various size, shape and heatshield material, and reentering under various entry conditions will continue. Measurements and analyses to develop and evaluate boost phase tracking and discrimination capability of a bistatic radar sensor system will be initiated. A laboratory model of an array of microprocessors for missile borne data processing will be utilized to demonstrate modular data processing hardware concepts for a spectrum of interceptor, threat, and sensor configurations. The development of critical technology elements of a Software Development System to support the cost effective construction of software, meeting the stringent requirements of quality, flexibility, and adaptability imposed by advanced BMD concepts will continue. Development and testing will be initiated for critical components of propulsion systems that power and control the payload stage of an optically-homing midcourse BMD interceptor. The operational high fidelity digital simulation model for the exoatmospheric interceptor ground test program will be upgraded and validated with results from ongoing dedicated ground tests of direct hardware-in-the-loop. Identification and verification of optical sensor concepts that have the potential to respond to the more complex and sophisticated threats will continue. The Sensor Performance in Radiation Environments (SPIRE) Program, which evaluates the performance of a nuclear hardened passive optical sensor in various radiation environments, will be completed. Two flights in support of the Designating Optical Tracker (DOT) flight program will be flown; data from the flights will be used in preparation for the remaining flights. Development of transmitters and receiver circuits which could yield cost effective performance over a variety of frequency ranges will continue. Laser radar developments will stress design of data gathering sensors using coherent waveforms to obtain target signatures for improved discrimination techniques. Procurement of an intelligence collection radar system will continue. Efforts to develop high quality

4. FY 1979 Planned Program: Development and evaluation of advanced techniques for rejecting traffic decoys will be conducted and performance of algorithms will be analyzed using simulated and recorded field radar data. Measurements to develop and evaluate boost phase tracking and discrimination capability of a bistatic radar sensor system will continue. Data processing hardware configurations to perform such functions as background rejection, target detection and tracking, discrimination, and multiple sensor data correlation and control will be evaluated. Identification, development and application of new data processing technology required for and resulting from major advances in sensor, interceptor, and Reentry Vehicle (RV) kill technologies, which offer significant improvements in ballistic missile defense will continue. Large subscale high burn rate motors will be tested in preparation for full scale motor ground tests; this technology will be available for subsequent flight demonstrations. Demonstration of the feasibility, by simulation and ground test, of performing homing guidance and fusing in the natural, nuclear, and vehicle-induced environments in the exo and high endo intercept regimes will continue. Fabrication of a mosaic sensor, which will improve exoatmospheric intercept capability by providing increased sensitivity and the capability to handle large numbers of targets, will be initiated. The currently planned flights for the DOT program will be completed; the flight program will provide data fundamental to the use of cold Long Wave Infrared sensors for performance of the designation, discrimination, and track functions. Development of a component and subsystem technology base in the laser and millimeter wavelengths which can provide

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Budget Activity #3 - Strategic Programs

Program Element #6.33.04.A

Title Ballistic Missile Defense Advanced Technology Program

increased range and doppler resolution, precise target metric data, and discrimination capability necessary to advanced ballistic missile defense concepts will continue. The development of an Advanced Digital Signal Processor will be completed. The acquisition of an intelligence collection radar system will continue. Technological issues for concepts will continue to be addressed. The increase in program funding level from FY 1978 to FY 1979 is necessary to offset the impact of inflation and to initiate new starts which offer the potential for revolutionary advancements in BMD.

5. Program to Completion: This is a continuing program.



FY 1978 ROTE DESCRIPTIVE SUMMARY

Program Element #6.33.08.A

Title Ballistic Missile Defense Systems Technology Program (BMDSTP)

Category Advanced Development

Budget Activity #3 - Strategic Programs

RESOURCES [PROJECT LISTING]: (\$ in Thousands)

| Project Number         | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost |
|------------------------|---------------------------|---------|---------|---------|---------|-------------------------------------|----------------------|
|                        | TOTAL FOR PROGRAM ELEMENT | 100000  | 24900   | 107688  | 122000  |                                     | Not Applicable       |
| QUANTITIES             |                           |         |         |         |         |                                     |                      |
| D 991                  | BMDSTP                    | 100000  | 24900   | 107688  | 122000  | Continuing                          | Not Applicable       |
| Military Construction: |                           |         |         |         |         |                                     |                      |
|                        |                           |         |         |         |         | None                                | 20400                |

BRIEF DESCRIPTION OF ELEMENT: This program element provides for the conduct of BMD systems technology Research and Development activities which will advance BMD systems state-of-the-art technology; maintain a minimum capability to initiate design/development of a deployable BMD system, if directed, and conduct systems definition studies and testing of selected components in a systems context to assess responsiveness to a variety of BMD missions.

BASIS FOR FY 1978 ROTE REQUEST: Provides for continuation of the validation program associated with terminal BMD systems. During this period the Systems Technology Radar will be utilized against targets of opportunity for final checkout of the total Kwajalein Missile Range Systems Technology Test Facility. Additional effort which will be conducted during this period includes investigation of optical adjuncts as an overlay to terminal defense systems, advanced digital signal processor (ADSP) and interceptor missile upgrades, key systems issues associated with mid-course exo-atmospheric intercepts, and initiation of system requirement studies for low altitude defense of potential targets such as the M-X system.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The FY 1978 budget increase over the FY 1977 appropriation is required to cover inflation costs and to expand the program to investigate new systems applications and new technological applications, as directed by the Congress and Office of Secretary of Defense, including defenses for national value targets and major component and subsystem level development, testing, integration, and validation under system concepts.

Budget Activity #3 - Strategic Programs

Program Element #6.33.08.A

Title Ballistic Missile Defense Systems Technology (BMDSTP)

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE) is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 152         | 0                  | 152          |
| (2) Contractor Employees   | 1745        | 0                  | 1745         |
| Total                      | 1897        | 0                  | 1897         |

DETAILED BACKGROUND AND DESCRIPTION: Initiated in FY 1971, the Site Defense program was designed to accomplish the technical and engineering tasks required to achieve a credible capability to defend MINUTEMAN or other high value targets in case Soviet ballistic missile force improvements became a threat to the US MINUTEMAN force. FY 1975 and FY 1976 Congressional budget authorization hearings resulted in guidance which reoriented the program from prototype demonstration to technology advancement. The presently planned program, now designated the Ballistic Missile Defense Systems Technology Program, was initiated in 1975 as a follow-on to the Site Defense program. The Systems Technology Program is working on advanced ballistic missile defense systems. The primary objective of the program is to retain a US posture where a full-scale development program on a required system incorporating the most advanced available technology could be initiated with an acceptable lead time to deployment. The program is looking at cost effective systems capable of defending a variety of nationally strategic targets such as MINUTEMAN; Strategic Air Command bases; submarine bases; major command, control, and communications complexes and switching centers; and other vital targets. This program continues to provide benefits to the US Strategic Arms Limitation community and negotiators, to the US strategic offensive nuclear arms research and development community, and to the US ballistic missile intelligence community.

RELATED ACTIVITIES: Related activities include testing at the Kwajalein Missile Range, 6.53.01.A; and the Ballistic Missile Defense Advanced Technology Program, 6.33.04.A.

WORK PERFORMED BY: Contractors: The major contractors for FY 1978 are expected to be: McDonnell-Douglas Astronautics Company, Huntington Beach, CA; TRW, Inc., Redondo Beach, CA; Control Data Corporation, Minneapolis, MN; General Electric Company, Syracuse, NY; Martin Marietta Corporation, Orlando, FL; and Brown Engineering Company, Inc., Huntsville, AL. Government: US Army Ballistic Missile Defense Systems Command, Huntsville, AL.

Budget Activity #3 - Strategic Programs

Program Element #6.33.08.A

Title Ballistic Missile Defense Systems Technology (BMDS/STP)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: Site Defense prototype development specifications for major subsystems were developed and design and fabrication of these subsystems were initiated. By end FY 1975, much of the prototype demonstration hardware had been fabricated and program restructuring to reorient emphasis in the program from prototype demonstration to advancement of systems technology had been completed. In FY 1976, the program was reoriented further to broaden the scope of systems technology investigations and fabrication and Continental U.S. testing of the hardware required for the Systems Technology Test Facility was essentially completed. During the FY 1977 period, the Test Facility hardware was shipped to the Kwajalein Missile Range.
2. FY 1977 Program: System simulation testing and analyses will continue at the System Simulation Center. Radar/data processor/software integration testing will be conducted at the Kwajalein Missile Range beginning early in FY 1977 with target of opportunity missions occurring in the second half of FY 1977. System level dedicated target mission planning for validation of terminal defense critical technical issues will continue, including procurement of target hardware. Component upgrade activity will continue with emphasis on the interceptor and advanced digital signal processor for terminal defense systems. Investigation and analyses of requirements for defending a variety of national assets such as Strategic Air Command bases; submarine ports; major command, control and communications complexes and switching centers and other vital targets will continue. Definitive effort on mid-course and low altitude defenses will continue.
3. FY 1978 Planned Program: In FY 1978 the initial bulk filter and discrimination test activity will be essentially completed and the adequacy of solutions to these key terminal defense technical issues will have been validated by test and analyses. Mission planning for the first series of system level dedicated target missions, primarily to supplement the validation of the key terminal defense technical issues, will be essentially completed and preparation for the first dedicated target mission scheduled for late FY 1979 will be well underway. Terminal Defense component upgrade effort, principally interceptor and advanced digital signal processor effort, will continue. Definitive effort (with some acquisition of long-lead time components for the mid-course validation program) for the mid-course and low altitude terminal defense validations will continue. Investigation and definition of requirements for defense of national value targets will be pursued. The cost increase in FY 1978 over FY 1977 is due primarily to inflation and the expansion of the program to investigate new systems applications.
4. FY 1979 Planned Program: The FY 1979 planned program basically continues the on-going effort and activities of FY 1978. The principal difference is completion of the basic terminal defense key technical issue validation program and the transfer of effort to the mid-course and low altitude terminal defense key technical issues validation programs. The core program activities involving program management and support, and operation and maintenance of the test facilities, and the terminal defense systems upgrade activity remain essentially the same. The cost increase in FY 1979 over FY 1978 is due primarily to inflation and the acquisition of test and target hardware for the mid-course terminal defense validation program.
5. Program to Completion: This is a continuing program.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.35.A Title Worldwide Military Command and Control Systems (WMCCS) Architecture

Category Advanced Development Budget Activity #3 - Strategic Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to  |                      |
|----------------|--------------------------------------|---------|---------|---------|---------|----------------|----------------------|
|                |                                      |         |         |         |         | Continuing     | Total Estimated Cost |
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 0       | 450     | 556     | 916     | Not Applicable | Not Applicable       |
| DH50           | WMCCS Architecture                   | 0       | 450     | 556     | 916     | Continuing     | Not Applicable       |

BRIEF DESCRIPTION OF ELEMENT: This continuing advanced program is in support of the Department of Defense (DOD) Worldwide Military Command and Control System (WMCCS) Architecture activity and Department of the Army studies relating to the overall DOD effort. This includes Studies and Analysis dealing with WMCCS architecture; systems engineering for broad command and control systems; and WMCCS/tactical command and control interfaces.

BASIS FOR FY 1978 RDTE REQUEST: In 1976, the Department of the Army request for the development of an Army Command and Control Master Plan (AC2MP) was approved by the Assistant Secretary of the Army (Financial Management) (ASA(FM)). The objective of the AC2MP was to define the Army's command and control capabilities required in the time period 1985 and to develop an architecture for the evolution from the current system to the 1985 system. The initial phase of the development effort was completed in November 1976. Follow-on efforts will culminate in an Army Command and Control Master Plan addressing alternatives of essential tactical and strategic requirements to meet specific Army C2 mission objectives. Deputy Secretary of Defense memorandum, 24 June 1976, designated the Department of the Army as cognizant agent to be responsible for the following efforts required to pursue the timely achievement of new capabilities in the WMCCS selected architecture and the initial designated Research and Development (R&D) efforts leading to long-range architecture decisions: Jan-Resistant Secure Communications, Hardened Command Facilities, Rapid Reaction Deployable Command, Control and Communications (C3).

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The Army Command and Control Master Plan addressing alternatives of essential tactical and strategic requirements to meet specific Army Command and Control mission objectives will be the main thrust in FY 1978. Increase in FY 1978 funds over FY 1977 will be placed on the development of the Army C2 Selected Architecture implementation plan.



Budget Activity #3 - Strategic Programs

Program Element #6.37.35.A

Title Worldwide Military Command and Control Systems (WWMCCS) Architecture

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE) and Procurement, is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 3           | 0                  | 3            |
| (2) Contractor Employees   | <u>30</u>   | <u>0</u>           | <u>30</u>    |
| Total                      | 33          | 0                  | 33           |

**DETAILED BACKGROUND AND DESCRIPTION:** This continuing advanced development program will accomplish the analysis, development, simulation, planning, and evaluation of equipment and techniques needed to ensure the development of a total Army Command and Control System configuration and the planning for the orderly acquisition of an adequately integrated and standardized system balanced in capability, survivability, and cost. This program will address the interface requirements between WWMCCS and tactical command and control systems. The techniques and equipment demonstrated in this program will enhance the survivability, interoperability, reliability, flexibility, security, and overall integration of Command, Control and Communications C3 elements fully responsive to the needs of the National Command Authorities and Department of the Army for the direction and control of all US military forces in all situations from day-to-day operations and non-conflict crisis management through general war. The Army, by Office of the Secretary of Defense (OSD) direction, has programed funding support for this program starting in FY 1976.

**RELATED ACTIVITIES:** This program is related to efforts being accomplished under the WWMCCS Selected Architecture, European Command, Control and Communications Study, US Army Europe (USAREUR) Command and Control Information System Study, and The Army Tactical Command and Control Master Plan.

**WORK PERFORMED BY:** The Director, Telecommunications and Command and Control, Deputy Chief of Staff for Operations and Plans, (DCSOPS), Department of the Army is the Program Manager and the Air Force Systems Command, through the Electronic Systems Division at L. G. Hanscom Air Force Base, Massachusetts, is responsible for contract administration. The International Business Machine (IBM) Corporation, Federal Systems Division, Arlington, Virginia, is the contractor for the Army Command and Control Master Plan.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The Army Command and Control Master Plan commenced in June 1976 under Program Element 6.51.01.A, Studies and Analyses. The contractor provided a detailed work plan which described the flow of the efforts necessary to achieve an architecture and a plan for its subsequent implementation. The plan contained details of the subtasks to be performed, the subtask interrelationships, the inputs required from the Government, key milestones and deliverables, and the schedule for performance and resources to be applied. Funding limitation permitted only completion of the initial phase of the plan development.

Budget Activity #3 - Strategic Programs

Program Element #6.37.35.A Title Worldwide Military Command and Control Systems (WWMCCS) Architecture

2. FY 1977 Program: The analysis of and planning for the long-range Army Command and Control Master Plan continued with the establishment of overall guidelines necessary for the integrated tactical and strategic development effort. Major areas addressed: (1) the Army operational environment including: defense policies, Army missions and command and force structure, and the postulated threat to command and control capabilities, all extending into the mid-1980's timeframe; (2) the situations and options extensions encompassing all Army missions in a set of scenarios which create the greatest anticipated stress upon command and control capabilities for both tactical and strategic systems; and (3) Army Command and Control System Architecture guidance which broadly describes the desired architectural alternatives for each level of conflict for which solutions must be created and outlines the criteria for evaluating these solutions for the tactical and strategic architects. Candidate configurations for the theater nuclear level of conflict have been developed for consideration in the final selection of the Army Command and Control System.
3. FY 1978 Planned Program: Architectural alternatives will continue to be developed in all situations from day-to-day management of forces, crisis situations, nuclear, conventional, and general war. Culmination of efforts is planned during this fiscal year to result: (1) in definition of issues to permit architectural alternatives to be structured; (2) creation of Situation/Options details required to define courses of action available for each strategic node and to specify the types of information that must be available at each node; (3) development of specific guidance and detailed evaluation techniques for the strategic architecture project; (4) development of alternative solutions to satisfy performance requirements necessary to determine the degree of support the solutions provide for each situation/option in specific threat environment; (5) development of an implementation plan for the Army Command and Control (C2) Selected Architecture. Further, efforts will continue in support of the European C3 Implementation Plan and the WWMCCS Selected Architecture. Increase in funding is minor but will be placed on the development of the Army C2 Selected Architecture implementation plan.
4. FY 1979 Planned Program: Continue with the implementation of the Army Command and Control System (ACCS) Master Plan selected architecture and with the implementation of the WWMCCS Selected Architecture. The increase in FY 1979 over FY 1978 is directly related to the development of rapidly deployable mobile vans for Joint Task Force Commanders, Battle Staffs, Executive Aids, Automatic Data Processing and Communications.
5. Program to Completion: This is a continuing program.

Budget Activity #3 - Strategic Programs

Program Element #6.37.35.A

Title Worldwide Military Command and Control Systems (WMMCCS) Architecture

6. Major Milestones:

- a. Army Command and Control System (ACCS) Theater
  - Nuclear Architecture
- b. ACCS Program Guidelines
- c. ACCS Theater Conventional Architecture
- d. Crisis Situation Architecture
- e. Post-Attack Architecture
- f. ACCS Architecture Alternatives
- g. ACCS Master Plan

| Estimated RDTE Cost to<br>Reach Events (Cumulative) |      |
|---|------|
| Date  |      |
| Oct 1977  | 750  |
| Feb 1978  | 750  |
| Feb 1978  | 750  |
| Jul 1978  | 1324 |
| Jul 1978  | 1324 |
| Jul 1978  | 1324 |
| Dec 1978  | 1824 |

# FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #2.37.24.A

Title Heavy Antitank/Assault Weapon (TOW)

Category Operational Systems Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                               | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|-------------------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT           | 8951    | 2899    | 544     | 515     | 0                        | 13137                |
|                | Quantities                          |         |         |         |         |                          |                      |
|                | Launchers                           |         |         |         |         |                          | 28                   |
|                | Missiles                            |         |         |         |         |                          | 472                  |
|                | Night Sights                        |         |         |         |         |                          | 50                   |
|                |                                     |         |         |         |         |                          | 11                   |
| D336           | Heavy Antitank/Assault Weapon (TOW) | 8951    | 2899    | 544     | 515     | 0                        | 13137                |
| Procurement:   |                                     |         |         |         |         |                          |                      |
|                | Funds (Includes Initial Spares)     | 139200  | 6600    | 59000   | 0       | 0                        | 886300               |
|                | Modifications (ECCM)                |         | 13700   | 0       | 41500   |                          |                      |
|                | Quantities                          |         |         |         |         |                          |                      |
|                | Launchers                           | 1842    | 0       | 577     | 0       | 0                        |                      |
|                | Missiles                            | 23813   | 1922    |         | 0       | 0                        |                      |
|                | Night Sights*                       | 0       | 0       | 0       | 0       | 0                        | 242                  |
|                | Modification: Launchers             | 0       | 445     | 0       | 2400    | 4332                     | 7177                 |
|                | Modification: Missiles              | 0       | 3700    | 0       | 13663   | 27325                    | 44688                |

\*Balance of procurement of TOW night sights transferred to Other Procurement Army as part of the Manportable Common Thermal Night Sight Program.

BRIEF DESCRIPTION OF ELEMENT: TOW (tube-launched, optically tracked, wire-command link guided missile system) is used against heavily armored vehicles and fortifications by Infantry units. It can be employed on a ground mount, is crew-portable, and is mounted on a variety of military vehicles including the helicopter.



#### #4 - Tactical Programs

#2.37.24.A

Title Heavy Antitank/Assault Weapon (TOW)

BASIS FOR FY 1978 ROUTE REQUEST: Continuation of the Engineering Development in the common module night sight program with major attention to test support and correction of deficiencies. Develop and integrate a closed cycle cooler in the TOW night sight system.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The decrease in FY 1978 from FY 1977 funds represents the normal decline in funding requirements as the RDTE program nears completion.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

TERMINATION COST: (\$ in Thousands)

|                            | RDTE | PROCUREMENT | TOTAL | FY 1977<br>and<br>Prior | FY 1978 | Total  |
|----------------------------|------|-------------|-------|-------------------------|---------|--------|
| (1) Federal Civ. Employees | 16   | 0           | 16    | 130578                  | 250     | 130828 |
| (2) Contractor Employees   | 30   | 6695        | 6725  |                         |         |        |
|                            | 46   | 6695        | 6741  |                         |         |        |
| Total                      |      |             |       |                         |         |        |

**DETAILED BACKGROUND AND DESCRIPTION:** The TOW is integral to the family of antitank weapons and is designed to defeat the heaviest known enemy armor out to ranges of 3,000 meters. TOW replaces the 106mm Recoiless Rifle in Infantry units. TOW provides a heavy antitank/assault capability for the infantry, airborne infantry, airborne infantry, and mechanized infantry battalions. It is crew-portable and can be employed on the ground or mounted in a variety of military vehicles. The missile can be fired from helicopters when the necessary airborne control equipment is provided. The missile is tracked in flight by an infrared sensor at the launcher and automatically guided by electronic commands transmitted over a wire link to the missile. The gunner has only to keep the crosshairs of the optical sight on the target until missile impact.

RELATED ACTIVITIES: The TOW night sight is the pilot program for developing common components for man-portable night vision devices. The components developed for the TOW night sight will also be used in such systems as the DRAGON Night Sight, the Night Observation Device Long Range (NODLR), and the Ground Locator Laser Designator (GLLD). A development was completed to provide protection for TOW crews against artillery fire using a ballistic blanket. Modifications to the M13A1 are under development to provide a TOW vehicle with crew protection (P.E. 6.36.26.A).

Budget Activity #4 - Tactical Programs

Program Element #2.37.24.A

Title Heavy Antitank/Assault Weapon (TOW)

WORK PERFORMED BY: The major contractors are Hughes Aircraft Company, Culver City, California; Emerson Electric Company, St. Louis, Missouri; and Texas Instruments, Incorporated, Dallas, Texas. The prime military proponent is the TOW Weapon System Project Manager, US Army Missile Research and Development Command, Huntsville, Alabama.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: The basic weapon system development was completed. The TOW thermal night sight (TNS) completed advanced development and entered engineering development (ED). Nine night sights were fabricated for Research and Development Acceptance Testing (RDAT) conducted in March 1975. A competition for the night sight development between Texas Instruments (TI) and Hughes Aircraft Company was won by TI to complete ED. The ED models of the TOW TNS started Developmental Testing at White Sands Missile Range in FY 1976 and Operational Tests in Europe in FY 1971.
- A solid state track link (SSL) electronic counter-measure (ECM) program was initiated to provide TOW with a low susceptibility to electronic countermeasures (ECM). The SSL program continued with the design, fabrication and contractor qualification testing of a new missile flare and detector array.
2. FY 1977 Program: The TOW night sight will complete DT II and OT II and is scheduled to begin Low Rate Initial Production. The SSL program will complete engineering development.
3. FY 1978 Planned Program: Continue thermal night sight engineering development with major emphasis on correction of deficiencies. Develop and integrate a closed cycle cooler into the TOW night sight system.
4. FY 1979 Planned Program: The TOW night sight development will be completed.

6. Major Milestones:

|  | Date   | Estimated RDTE Cost to Reach Events (Cumulative) |
|--|--------|--|
| a. Enter Engineering Development             | Apr 63 | 10.0M  |
| b. DT II/OT II Completed                     | Jul 69 | 90.0M  |
| c. Type Classification Standard              | Sep 70 | 100.0M   |
| d. First Unit Equipped                       | Sep 70 | 100.0M   |
| e. Enter Night Sight Engineering Development | Jan 74 | 104.1M   |
| f. Enter ECM Engineering Development         | May 74 | 108.0M   |

Budget Activity #4 - Tactical Programs

Program Element #2.27.24.A

Title Heavy Antitank/Assault Weapon (TOW)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. Development of the TOW Missile System was initiated in October 1963. The prime contractor for TOW is Hughes Aircraft Company (HAC).

b. DT I (Engineer Design Tests) started in August 1963 and were completed in March 1967. In addition to contractor tests, tests were conducted by Army Missile Command and Army Electronics Command at Huntsville, Alabama. Major deficiencies with the missile case and missile light sources were discovered during this testing.

c. DT II (Engineer Test/Service Test) was conducted from December 1966 to July 1969 by Test and Evaluation Command (TECOM) at White Sands Missile Range, New Mexico; Fort Benning, Georgia; and Fort Greely, Alaska. The major deficiencies with the missile case and light source discovered during DT I had been corrected and no further major deficiencies were discovered.

d. DT III (Initial Production Test) was conducted from November 1969 to May 1970 by TECOM. This test verified that the hard tooled production items met production specifications and had the same characteristics as the prototypes.

e. A night sight program was initiated in 1968 to provide the TOW weapon system with a night fighting capability without the use of artificial illumination. A pulse gated, laser aided sight was developed and tested. The maximum range of this sight varied from 700 to 1,600 meters depending on the amount of ambient light. The rapid improvement in far infrared technology resulted in termination of the pulse gated night sight program. In March 1972, a program was initiated to develop a TOW thermal night sight that will enable detection of targets out to the full 3,000 meter range of the system. Prototypes from three contractors were evaluated during Developmental Test I (DT I) from December 1972 - May 1973 by Electronics Command at both the Night Vision Laboratory (NVL), Fort Belvoir and Missile Command facilities, Huntsville, Alabama. Prototypes from two contractors entered final competition. They were Hughes Aircraft Company (HAC) and Texas Instruments (TI). Government tests included Laboratory Performance Tests at NVL from 18 Feb to 27 Jun 1975, Firing Tests at Redstone Arsenal from 3-22 Mar 1975, Acquisition Tests at Camp A.P. Hill from 2 Apr to 19 May 1975, and other systems and handling tests held at Redstone Arsenal and Fort Benning. Results of Acquisition Tests during clear weather were Detection, meters, and Recognition, meters. Firing results are included in paragraph 8. The TI sight won the competition and continues in Engineering Development. DT II started Jun 1976 and will end Mar 1977. DT II is being conducted at White Sands Missile Range (WSMR) by United States Army Test and Evaluation Command (TECOM). DT III is scheduled during 4th Quarter FY 1978 and 1st Quarter FY 1979. DT III will be conducted at WSMR by TECOM.

Budget Activity #4 - Tactical Programs

Program Element #2.37.24.A

Title Heavy Antitank/Assault Weapon (TOW)

f. Research was conducted by HAC from FY 1965 through FY 1971 to provide electronic counter-countermeasures ECCM hardening for the TOW system. In FY 1971 TI proposed a solid state track link (SSTL) to provide ECCM hardening for TOW. DT I tests were successfully conducted in July 1972 using an SSTL launcher and three hardened missiles. An engineering development (ED) contract competition followed with a contract awarded to TI in May 1974. ED is scheduled to end Sep 1977. In 1975, four SSTL breadboard and five solid state track link (SSTL) prototype missile firings were conducted at 3000 meters from hardened launchers. Four of the missiles were unhardened since the hardened launcher must be capable of firing the unhardened missile.

During

March to July 1976 the contractor adjusted the missile flight data link against jammers. Combined DT/OT II is scheduled Jan-May 1977 at White Sands Missile Range with United States Army Infantry Board (USAIB) as the test organization. DT III is scheduled for 4th quarter FY 1978.

g. A tabulation of TOW missile test firings follows:

Summary of Test Firings

| <u>Test Program</u>                              | <u>Dates</u>      | <u>Launches</u> <u>1/</u> | <u>Hit</u> <u>2/</u> <u>(1)</u> | <u>No</u> <u>Test</u> <u>(2)</u> | <u>No</u> <u>Test</u> <u>(3)</u> | <u>No</u> <u>Test</u> <u>3/</u> <u>(4)</u> |
|--|-------------------|---------------------------|---------------------------------|----------------------------------|----------------------------------|--|
| Contractor Prototype Test                        | Before July 1966  |                           |                                 |                                  |                                  |  |
| Service Test Missiles                            | Jul 1966-Mar 1967 |                           |                                 |                                  |                                  |  |
| Engineering Test/Service Test<br>Prior to Aug 67 | Apr 1967-Aug 1967 |                           |                                 |                                  |                                  |  |
| Environmental Test<br>Tropic                     | Aug 1970-Sep 1971 |                           |                                 |                                  |                                  |  |
| Arctic   | Nov 1970-Feb 1971 |                           |                                 |                                  |                                  |  |
| Desert   | Jun 1970-Nov 1970 |                           |                                 |                                  |                                  |  |

Budget Activity #4 - Tactical Programs

Program Element #2.37.24.A

Title Heavy Antitank/Assault Weapon (TOW)

Research Development Acquisition

Tests (RDAT/OT Ia)

TOW (AN/TAS-4) Night Sight  
(Stationary & Moving Targets)

3-22 Mar 1975

Feb-Mar 1975

Jul-Oct 1975

SSTL Breadboard Firing\*

SSTL Prototype Firing\*

\* Misses due to Beacon failures.

1/ Total number of recorded missile launches during the test.

2/ Number of recorded missile launches minus reliability failures.

3/ See NOTES.

NOTES:

1. Hits are scored on 7.5 x 7.5 ft. stationary targets and 7.5 x 15 ft. moving targets.
2. No test was indicated when missiles were fired outside range or environmental requirements.
3. No test due to gunner error, firing through brush or over water.
4. Two missed due to "canned" launch shift, one missed due to noise in launcher electronics. No misses were due to the night sight.

2. Operational Test and Evaluation:

a. Confirmatory troop test was conducted from July to September 1970 at Camp Roberts, California, by the U.S. Army Combat Developments Command (CDC) using a trained TOW platoon under simulated tactical conditions. Objectives of the test included an evaluation of the TOW system when operated by typical user troops in a simulated battlefield situation and a comparison of the TOW with the 106mm Recoilless Rifle. The TOW missile system outperformed the 106mm Recoilless Rifle in all tests and performed well under simulated tactical conditions.



Budget Activity #4 - Tactical Programs

Program Element #2.37.24.A

Title Heavy Antitank/Assault Weapon (TOW)

b. The TOW weapon system was accepted for service use (Typed Classified Standard A) in September 1970 and the first tactical units were equipped in Europe in October 1970. Issue of launchers to USAEUR based forces was completed in February 1976. Issue to U.S. forces in Korea has been completed and distribution initiated to Continental United States Forces. With approximately 630 production missile firings, the weapons system is performing well. The system was deployed to U.S. Forces in Vietnam in May 1972 and was praised as a highly successful weapon system in combat. Based on operational use, major planned modifications to the TOW system include a solid state track link to provide hardening and the addition of a thermal night sight.

c. TOW night sight has been incorporated into the manportable common thermal night sight (MCTNS) program and underwent operational testing in Europe in MCTNS OT II, completed Nov 1976. The TOW night sight portion of MCTNS OT II was conducted with production prototype items by the Operational Test and Evaluation Agency (OTEA), using one mechanized infantry company team provided by USAEUR. MCTNS OT II assessed the operational performance and suitability, to include reliability, availability, and supportability of the TOW night sight by typical user troops in as realistic a combat environment as possible. MCTNS OT III, including production TOW night sights, is scheduled for Oct-Nov 78.

3. Systems Characteristics:

Operational/Technical Characteristics

Range

Minimum  
Maximum

With Night Sight

Probability of a Kill given a Hit

System Reliability

Probability of a Hit given a Reliable

Round-Stationary Targets

Moving Targets

Using Night Sights against Stationary Targets

1/ Developmental and Operational Firings.

2/ Sight is in Engineering Development Stage.

3/ Analytical Data.

4/ TOW's Probability of Hit given a Reliable System is higher than predicted. Overall mission accomplishment or probability

Objective

Performance 1/

65M  
2000M

65M  
3000M

2/ 5/  
3/ 3/  
4/ 1/

5/

Budget Activity #4 - Tactical Programs

Program Element #2.37.24.A

of a first hit is computed by multiplying probability of hit given a reliable system by system reliability. Overall mission accomplishment is higher than the requirement and therefore the Army accepts the demonstrated reliability.

5/ Hitting performance during the combined Research Development Acquisition Tests (RDAT)/Operational Test Ia, with user troops, was

Title Heavy Antitank/Assault Weapon (TOW)

FY 1978 ROUTE DESCRIPTIVE SUMMARY

Program Element # 2.37.26.A Title Tactical Fire Direction System (TACFIRE)

Category Operational System Budget Activity # 4 - Tactical Programs

RESOURCES/PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                |                           |         |         |         |         |                          |                      |
|                | TOTAL FOR PROGRAM ELEMENT | 4613    | 5409    | 828     | 747     | 0                        | 90057                |
|                | Quantities                | 0       | 0       | 0       | 0       | 0                        | 9 1/                 |
| D322           | TACFIRE                   | 4613    | 5409    | 828     | 747     | 0                        | 90057                |
| Procurement    | Funds                     | 8000    | 30200   | 69500   | 89500   | 73200                    | 313000               |
|                | Quantities                | 0       | 8       | 23      | 44      |                          | 2/                   |

1/ Includes 5 test systems and 2 system equivalents each for training and software support. Test systems to be refurbished for issue.

2/ Total requirement is [ ] systems including 5 refurbished test systems.

BRIEF DESCRIPTION OF ELEMENT: TACFIRE is a computer based tactical automatic data processing system which performs selected field artillery tactical and technical fire control functions.

BASIS FOR FY 1978 ROUTE REQUEST: The FY 78 request provides for in-house support, development of TACFIRE peculiar software to be used with automatic test equipment (ATE) at selected general support and depot maintenance facilities in support of TACFIRE, and engineering change proposals resulting from Developmental/Operational Test III.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Completion of all major program development efforts in FY 1977, except test and ATE software permits a decrease in the funding level.

Program Element # 2.37.26.A

Title Tactical Fire Direction System (TACFIRE)

TERMINATION COST: (\$ in Thousands)

|   |      | (1)         | Estimated Govern-<br>ment Liability<br>Financed with: | FY 1978 | TOTAL  |
|---|------|-------------|---|---------|--------|
|   |      |             | RDTE  |         |        |
|   |      |             | Procurement   |         |        |
| The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows: |      |             |   |         |        |
| (1) Federal Civ. Employees  | RDTE | PROCUREMENT | TOTAL   |         |        |
|   | 3    | 0           | 3   |         |        |
| (2) Contractor Employees  | 23   | 533         | 556   | 90      | 88387  |
|   |      |             |   | 11300   | 95000  |
| TOTAL   | 26   | 533         | 559   | 11390   | 183387 |

**DETAILED BACKGROUND AND DESCRIPTION:** Commanders in future conflicts will face a sophisticated enemy with advantages in size, mobility, force, fire support, armor capability, and tactical air. These enemy advantages can be minimized through improvement of the commander's decisions and responsive execution of firepower. Until 1964, manual procedures were used entirely to perform fire control functions in field artillery fire direction centers. Since that time, the field artillery Digital Automatic Computer (FADAC) has been issued to field artillery units to compute ballistic and survey data. The objective of this program is to provide the advantages of automatic data processing techniques to those functions as well as selected additional field artillery fire control functions. The Tactical Fire Direction System (TACFIRE) is a completely integrated system of tactical computer elements located at the fire direction centers of Active Army field artillery battalions, field artillery groups, division artilleries, and corps artilleries which will provide for automatic transmission, receipt and computation of firing data. Field artillery functions to be automated with the system include tactical and technical fire control, nuclear and non-nuclear fire planning, processing of artillery target intelligence, preliminary target analysis, fallout predictions, distribution of meteorological data, and maintenance of ammunition and fire unit status. TACFIRE will be interoperable and interface with the Tactical Operations System (TOS) and possibly with other Army Tactical Data Systems (ARTADS) within the conceptual framework of the Tactical Command and Control program as they are fielded. TACFIRE will use an integrated system of computers, local and remote input/output devices, digital storage and retrieval devices, display units and control consoles. TACFIRE will increase the effectiveness of field artillery fire support through increased accuracy, better and more rapid use of target information, reduced reaction time, and greater efficiency in the determination of fire capabilities and the allocation of fire units to engage targets. TACFIRE is designed to replace the present combination of manual and FADAC computational procedures for determination of fire commands, fire planning data, correlation of target intelligence and target analysis.

Budget Activity # 4 - Tactical Programs

Program Element # 2.37.26.A

Title Tactical Fire Direction System (TACFIRE)

RELATED ACTIVITIES: This program element has application in program elements 6.37.22.A (Tactical Operations System (TOS)) and 6.43.02.A (Air Defense Control and Coordination System, AN/TSQ-73). To the maximum extent possible, equipment developed for TACFIRE is being used in other Army Tactical Data Systems (ARTADS), such as TOS and the AN/TSQ-73, which require militarized hardware. Advanced development of the Digital Message Device was accomplished under project 6.37.23.A D101 (Integration of ARTADS) which also supports developments to meet TOS/TACFIRE interoperability requirements. D101 also supports the computer emulation effort which may provide a fourth generation processor which could replace the computer used in TACFIRE, TOS, AN/TSQ-73, and the AN/TTC-39 without impact on already developed software. The Battery Level Computer, being developed under program element 6.47.27.A (Command and Control) will replace the current TACFIRE Battery Display Unit. Liaison is conducted at laboratory level and by the Project Manager with developers of automatic data processing systems in other Services to preclude duplication of effort.

WORK PERFORMED BY: The Project Manager, Army Tactical Data Systems (PM ARTADS), US Army Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey, is the developer of this system. Technical support is furnished by the US Army Computer Systems Command, Fort Belvoir, Virginia, and the Communications/Automatic Data Processing Laboratory, US Army ERADCOM, Fort Monmouth, New Jersey. Contractors for the system are the Data Systems Division, Litton Industries, Van Nuys, California, and the Magnavox Company, Fort Wayne, Indiana. Software for the automatic test equipment to be used in support of TACFIRE is being developed by the Radio Corporation of America, Burlington, Massachusetts. Additional contractual support has been performed by Auerbach Associates, Inc., Philadelphia, Pennsylvania, and Meta Systems Corporation, Trenton, New Jersey. System testing is being performed by the US Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland, and the US Army Training and Doctrine Command's Combined Arms Test Activity, White Sands Missile Range, New Mexico. The US Army Training and Doctrine Command, Fort Monroe, Virginia, is performing the cost and operational effectiveness analysis for the system.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Prior to 1967 software systems, design descriptions, and test programs for TACFIRE were written. Three contractors participated in a six-month competitive contract definition phase. Evaluation of contract definition proposals resulted in award of a Total Package Procurement (TPP) contract covering development and procurement with Litton Systems Incorporated in December 1967. The contract underwent major changes in 1970 to include the addition of a random access memory to increase storage capacity for the battalion computer. Software was integrated into the system during FY 70 and initial acceptance tests completed. Research and Development Acceptance Tests (RDAT) were completed in March 1972 and the prototype system entered a scheduled one year period of development testing at Fort Sill, Oklahoma; Fort Huachuca, Arizona; and White Sands Missile Range, New Mexico, on 1 April 1972. Testing at Fort Huachuca, primarily



Budget Activity # 4 - Tactical Programs

Program Element # 2.37.26.A

Title Tactical Fire Direction System (TACFIRE)

Environment and electromagnetic compatibility and vulnerability testing, progressed satisfactorily and was completed in August 1972. Extensive system deficiencies in both the hardware and software portions of the prototype system interrupted the continuity of testing at Fort Sill and White Sands. Despite management actions which included accelerated correction of deficiencies, relocation of equipment, adjustments to the test schedule and the designation of the Commander, US Army Field Artillery Center as the official user of the system, it became evident that the Army would be unable to make a production decision on schedule. During the 2d and 3d Quarters, FY 1973, the system was intensively reviewed by the Army Systems Acquisition Review Council (ASARC) and the Defense Systems Acquisition Review Council (DSARC). This review included revalidation of the requirements for the systems and thorough investigation of various alternatives for continuing the program. In March 1973 the decision was approved by the Office of the Secretary of Defense to restructure the contract to a Cost Plus Fixed Fee (CPFF). The principal provisions of restructure deleted production commitments provided options for low rate initial production and full scale production, and provided additional time (12 months) for correction of deficiencies (at the contractor's expense) and development of new/upgraded components identified by the user as essential. The program for correction of deficiencies and development of new/upgraded items continued until March 1974. Development Tests/Operational Tests II (DT/OT II) were conducted during the period May-November 1974; test results supported proceeding to the next step in the acquisition cycle. A cost and operational effectiveness analysis, incorporating data generated during field testing, was completed in December 1974 and showed the system to be cost effective. The January 1975 DSARC authorized the limited procurement of 14 systems which will support further developmental and operational testing (DT/OT III) prior to a full scale production decision. In August 1975 Engineering Development was initiated to provide a new forward observer's device, the Digital Message Device (DMD). DMD prototypes were delivered and DT/OT II initiated in June 1976. Also in FY 1976, the Field Artillery School (FAS) cadre was trained by the contractor, and DT/OT III training was initiated by the contractor and FAS. In September 1976 the Army initiated action to continue limited procurement at the rate of one system per month. These additional 16 systems would keep the production line warm until full scale production deliveries begin in FY 79 thereby reducing program cost by an estimated \$8.3M, equipping 3 divisions complements significantly earlier than the present program, and maintaining key contractor production and test personnel.

2. FY 1977 Program: All program development objectives, other than testing and development of automatic test equipment (ATE) software, should be completed by the end of the period. The FY 77 program includes completion of DT/OT II for the DMD and training for TACFIRE DT/OT III by the contractor and FAS, conduct of TACFIRE First Article Configuration Review and First Article Test, start and completion of limited procurement of the DMD and initiation of TACFIRE DT/OT III (including the DMD). Also planned is initiation of production of 16 additional limited procurement systems.

3. FY 1978 Planned Program: Planned events include completion of DT/OT III, update of the cost and operational effectiveness analysis, the full scale production decision and release, type classification standard, and initial operating capability. The completion in FY 77 of all development efforts, other than testing and automatic test equipment software, permits a decrease in funding.

Budget Activity # 4 - Tactical Programs

Program Element # 2.37.26,A

Title Tactical Fire Direction System (TACFIRE)

4. FY 1979 Planned Program: During this period development of automatic test equipment software will be completed and full scale production deliveries will begin.

5. Program to Completion: Full scale production deliveries.

6. Major Milestones:

| Events  | Date                         | Estimated RTE Cost to |              |
|---|------------------------------|-----------------------|--------------|
|   |                              | Reach Events          | (Cumulative) |
| a. Developmental Test/Operational Test (DT/OT) II | May 1974 to November 1974    | 71.4                  |              |
| b. Limited Procurement Initiated                  | January 1975                 | 75.4                  |              |
| c. First Article Test                             | January 1977 to April 1977   | 85.6                  |              |
| d. DT/OT III                                      | August 1977 to February 1978 | 89.2                  |              |
| e. Full Scale Production Initiated                | July 1978                    | 89.2                  |              |

Budget Activity # 4 - Tactical Programs

Program Element # 2.37.26.A

Title Tactical Fire Direction System (TACFIRE)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: Developmental Test (DT) II was conducted 13 May-8 November 1974 by the US Army Test and Evaluation Command at Fort Sill. DT II showed the system to be within Decision Coordinating Paper (DCP) operational thresholds except for Mean Time to Repair (MTTR) which was 34 minutes compared to the 33 minute threshold. The impact of this one minute breach is a reduction in system inherent availability from 99.55% to 99.54% which is not considered serious. Actions in progress, designed to reduce MTTR to within threshold, include improvements in maintenance and diagnostic software routines, draft technical manuals and organization level test equipment. Based on chargeable systems failures, the Mean Time Between Failures (MTBF) at the end of DT II was 123 hours which is more than double the 60 hour DCP threshold for DT/OT II. Reliability improvements are being made which should increase system MTBF above the revised DCP threshold for DT/OT III of 150 hours. Prior to TACFIRE DT III, correction of deficiencies (hardware and software) and changes to the DT/OT II baseline will be verified; DT II for the Digital Message Device (DMD) will also be conducted. The DSARC approved development of the DMD to replace the unsatisfactory Fixed Format Message Entry Device (FFMED). First Article Test (FAT) will be conducted during the period November 1976 to March 1977 at the contractor's plant in Van Nuys, CA, and White Sands Missile Range by the contractor. DT III will be conducted at White Sands Missile Range during the period August to September 1977. The length of DT III has been reduced by incorporating DT III requirements into FAT. Except for the DMD which is being developed by the Magnavox Company, the development contractor is the Data Systems Division of Litton Industries.

2. Operational Test and Evaluation: OT I was not conducted. OT II was conducted by the US Army Operational Test and Evaluation Agency (OTEA) at Ft. Sill, 13 May 1974 to 26 July 1974 as part of a combined DT/OT II. A provisional Division Artillery staff was formed for the test and tactical troops and lower level units operated the TACFIRE equipment during operational testing. Results of operational testing showed that TACFIRE is superior overall to the existing primarily manual system from the standpoint of speed, accuracy and appropriateness of response, with regard to fire mission processing, tactical fire direction, fire planning and information handling. Tactical fire direction personnel can operate TACFIRE equipment after receiving substantial training. Current doctrine and organization for employment of TACFIRE is adequate but it is felt that greater advantage of TACFIRE and savings in personnel and equipment can be obtained by study and refinement of TACFIRE doctrine and organization (personnel and equipment).

The operational mean time between failure during OT II was 89.4 hours for the entire system to include software and peripheral and remote devices on hand. OT II of the DMD is scheduled for Sep-Oct 76 at White Sands Missile Range and Fort Sill. This test will address the suitability of the DMD to replace the FFMED.

Budget Activity # 4 - Tactical Programs

Program Element # 2.37.26.A

Title Tactical Fire Direction System (TACFIRE)

A TACFIRE Force Development Test and Experimentation is planned for May-Jul 77 at White Sands Missile Range. Operational Test (OT) III will be conducted at Fort Hood by the U. S. Army Training and Doctrine Command's Combined Arms Test Activity during the period January to February 1978. Testing will address the readiness of TACFIRE to enter full scale production. The OT III test unit is the 1st Cavalry Division. Following OT III and prior to the production decision, the U. S. Army Operational Test and Evaluation Agency will prepare an Independent Evaluation of the system.

3. System Characteristics: (as of 30 September 1976)

| <u>Operational/Technical Characteristics</u> | <u>Approved Program</u> | <u>Demonstrated</u> |
|--|-------------------------|---------------------|
| Mission Response Times (Sec)                 |                         |                     |
| a. Fire Mission, Battalion                   | 10                      | 15.5 1/             |
| b. Fire Mission, Division                    | 20                      | 19 1/               |
| c. Nuclear Fire Planning                     | 240                     | 21 1/               |
| d. Non-Nuclear Fire Planning                 | 900                     | 792 1/              |
| e. Preliminary Target Analysis               | 60                      | 8 1/                |
| f. Nuclear Target Analysis                   | 180                     | 195 1/              |
| Mean-Time-to-Repair (MTTR) (Min)             | NOT MORE THAN 30        | 34 3/               |
| Mean-Time-Between-Failures (MTBF) (Hrs)      |                         |                     |
| a. Battalion Fire Direction Center (FDC)     | 150                     | 123 2/              |
| b. Division Artillery FDC                    | 150                     | 123 2/              |

Budget Activity # 4 - Tactical Programs

Program Element # 2.37.26.A

Title Tactical Fire Direction System (IACFIRE)

Data Transmission Accuracy

a. Undetected Errors (bits)

1 in 10<sup>6</sup> 1 in 10<sup>6</sup> 4/

b. Detected Errors (bits)

1 in 10<sup>5</sup> 1 in 10<sup>5</sup> 4/

- 1/ Results of software transition test conducted at contractor's plant (Van Nuys, CA) in June 1975.
- 2/ As stated in revised Decision Coordinating Paper dated 15 Jul 75; to be accomplished by end of Developmental Test / Operational Test III. Mean Time to Repair threshold is 33 minutes.
- 3/ Developmental Test / Operational Test II combined data.
- 4/ Results of data accuracy tests conducted at Fort Huachuca, AZ, Apr-Aug 72.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #2.37.27.A Title Medium Anti-Tank Assault Weapon (DRAGON)

Category Operational Systems Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                            | FY 1976     | FY 1977     | FY 1978     | FY 1979     | Additional to Completion | Total Estimated Cost |
|----------------|----------------------------------|-------------|-------------|-------------|-------------|--------------------------|----------------------|
|                | <u>TOTAL FOR PROGRAM ELEMENT</u> | <u>2545</u> | <u>4004</u> | <u>2836</u> | <u>1208</u> | <u>0</u>                 | <u>121949</u>        |
|                | Quantities                       |             |             |             |             |                          |                      |
|                | Trackers                         |             |             |             |             |                          | 39                   |
|                | Missiles                         |             |             |             |             |                          | 822                  |
|                | Night Sights                     |             |             |             |             |                          | 29                   |
|                | Launch Simulator (LS)            |             |             |             |             |                          | 19                   |
|                | Viscous Damped Mount (VDM)       |             |             |             |             |                          | 17                   |
| D306           | Guided Missile Surface Attack    | 2545        | 365         | 2836        | 1208        | 0                        | 121949               |
| Procurement:   | Funds                            | 92600       | 23100       | 44700       | 20200       | 32500                    | 475600               |
|                | Quantities                       |             |             |             |             |                          |                      |
|                | Trackers                         | 1624        | 530         | 2540        | 0           | 0                        |                      |
|                | Missiles                         | 19300       | 5940        | 6965        | 4464        | 0                        | 4134                 |
|                | VDM                              | 0           | 0           | 0           | 0           | 0                        | 1094                 |
|                | Launch Simulator                 | 0           | 0           | 0           | 1094        | 0                        |                      |

BRIEF DESCRIPTION OF ELEMENT: DRAGON is an accurate medium antitank/assault weapon that is lightweight and manportable. The gunner keeps the crosshairs of the optical sight on the target until impact. A beacon in the tail of the missile is sensed by the gunner's tracker and electric guidance commands are sent to the missile via a wire link.

BASIS FOR FY 1978 RDTE REQUEST: The funds are required for continuation of night tracker development and development of an improved second generation training device (launch simulator).

Budget Activity #4 - Tactical Programs

Program Element 1.37.27.A Title Medium Anti-Tank Assault Weapon (DRAGON)

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The last year of funding for the Viscous Damped Mount development is FY 1977. Also, the combination of night tracker and launch simulator developments, both nearing completion, cause the FY 1978 program to decrease from the FY 1977 level.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |                       | <u>FY 1977</u><br>and<br><u>Prior</u> | <u>FY 1978</u> | <u>Total</u> |
|----------------------------|-------------|--------------------|--------------|-----------------------|---------------------------------------|----------------|--------------|
| (1) Federal Civ. Employees | 5           | 0                  | 5            | (1) Estimated Govern- | 422300                                | 3000           | 425300       |
| (2) Contractor Employees   | 42          | 701                | 743          | ment Liability        |                                       |                |              |
|                            |             |                    |              | Financed with:        |                                       |                |              |
| Total                      | 47          | 701                | 748          |                       |                                       |                |              |

DETAILED BACKGROUND AND DESCRIPTION: The DRAGON is a weapon system which provides the infantryman with an improved capability against tanks and hard targets over that provided by its predecessor (90mm Recoilless Rifle M67). DRAGON is the US Army's medium range antitank/assault weapon that is lightweight, manportable, accurate, and lethal. It will provide an antitank/assault capability for all infantry platoons. The primary purpose of the weapon is to defeat enemy armored vehicles at ranges out to 1,000 meters. It also will be employed against fortifications, emplacements, and other materiel targets. DRAGON weighs 30.9 pounds in a ready-to-fire condition. The weapon is comprised of a 25.4 pound "round" made up of a launcher and missile, both expendable, and a non-expendable tracker weighing 6.5 pounds. DRAGON utilizes a command line-of-sight guided missile that is tube launched with minimum recoil and is optically tracked and guided to a target by electrical impulses transmitted by a wire link. DRAGON will be organic to infantry companies and employed at the platoon level. The Viscous Damped Mount will provide increased stability and tracking capability for DRAGON when fired from the M113A1 Armored Personnel Carrier or from the ground mount of the M60 machine gun.

RELATED ACTIVITIES: The DRAGON Night Tracker, now under development, will utilize components common to the TOW Night Sight. This is part of an Army Program to establish standardized components for manportable Night Vision Devices such as the TOW and DRAGON Night Sights, the Night Observation Device Long Range (NODLR), and the Ground Locator Laser Designator (GLLD).

WORK PERFORMED BY: The development and previous prime contractor is McDonnell Douglas, Titusville, Florida. McDonnell Douglas will continue to deliver trackers and missiles through the end of CY 1977. The multi-year prime contractor for trackers, as of Sep 76, is Kollisman Instruments Company, Nashua, New Hampshire. Raytheon Company, Bristol, Tennessee, is the new prime contractor for missiles. The prime military proponent is the DRAGON Weapon System Project Manager, US Army Missile Research and Development Command, Huntsville, Alabama.

Budget Activity #4 - Tactical Programs

Program Element #2.37.27.A

Title Medium Anti-Tank Assault Weapon (DRAGON)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: DRAGON entered engineering development in 1966. The pilot production line was completed in 1970. ASARC III/DSARC III approved the continuation of production at a low rate. System and training equipment was type classified standard. Second source contracts were awarded to Round and Tracker producers. The following major test programs were completed: System Engineering Test (DT II); System Expanded Service Test (DT II/OT II); Launch Effects Trainer (LET) Check/Operational Test (LC/OT) on training equipment; DT III on LET (follow-on from the LC/OT) and System OT III. Decision was made not to type classify or procure DRAGON's AN/TAS-3 Night Vision Sight. Engineering development began on the Common Module AN/TAS-5 Night Vision Sight. The Texas Instrument AN/TAS-5 Thermal Night Sight concept was selected for full scale engineering development. The AN/TAS-5 was integrated into a bracket to which the DRAGON Day Tracker was bolted-on. This bolt-on sight, as it was referred to, encountered bore sight shift problems that were partially corrected by strengthening the mount. The strengthened mount was heavier than the user desired. A prototype model of an Integrated Night Tracker (INT) was made which combined common Thermal Night Sight and Day Tracker components thus conserving weight. Decision was made to proceed with INT development. The first tactical unit (1/509th Infantry USAREUR) was equipped. ASARC IIIa approved DRAGON for full production. Competitive contracts, on a 60-40 basis, were awarded on the Round and Tracker for FY 1975 and FY 1976 procurements. The Decision Coordinating Paper (DCP), developed in support of DSARC IIIa decision, was approved by OSD. The Viscous Damped Mount (VDM) and Launch Simulator (LS) began development. Discussions continued within the Army concerning the need for developing additional and improved training equipment. A follow-on OT IIIa system test was completed at Fort Bragg, North Carolina. A multi-year production contract was competed with Kollsman Instrument Company winning the primary Tracker contract and Raytheon Company winning the primary missile contract.

2. FY 1977 Program: VDM qualification tests will be completed and DT/OT II started. Development will continue throughout FY 1977 on LS.

3. FY 1978 Planned Program: LS development, including DT/OT II, will be completed. The INT will continue in engineering development.

4. FY 1979 Planned Program: Development will be completed on the INT.

5. Program to Completion: Not applicable.

Major Milestones:

- a. Engineering Development Contract Award
- b. Development/Operational Test II Completed (Temperate Phase)
- c. System Type Classified
- d. First Unit Equipped (Europe)

| Date   | Estimated RDTE Cost to Reach Events (Cumulative) |
|--------|--|
| Feb 66 | 8.7M   |
| Nov 72 | 100.1M   |
| Feb 73 | 107.5M   |
| Jan 75 | 108.6M   |

Budget Activity #4 - Tactical Programs

Program Element #2.37.27.A

Title Medium Antitank Assault Weapon (DRAGON)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

- a. The development and previous prime contractor is McDonnell Douglas, Titusville, Florida. McDonnell Douglas will continue to deliver trackers and missiles throughout the end of CV77. The multi-year prime contractor for trackers, as of Sep 76, is Kollsman Instruments Company, Nashua, New Hampshire. Raytheon Company, Bristol, Tennessee, is the new prime contractor for missiles.
- b. Prototype Flight Evaluation Test (DT I) was accomplished by the US Army Missile Command from September 1966 to November 1971. The testing included components tests, launch environment tests, system integration tests and guided flight tests. The flight test program included a 157 round guided flight test with 91 unmanned firings and 66 manned firings against both moving and stationary targets. Problems encountered involved the flare lamp and window, guidance wire and the gyro. A 78 round engineering analysis and design verification flight program was conducted between March and October 1971 to correct reliability and quality control problems. Additional problems with guidance wire breakage were found. Fixes were applied to the missile and prototype flight evaluation test conducted at Redstone Arsenal, Alabama with firings in October and November 1971. Failures occurred in firings and were attributed to quality control problems in the firing circuit board and the gyro. Changes were instituted in the assembly quality control.
- c. Engineering Test/Service Test (DT II) (ET/ST) was conducted by US Army Test and Evaluation Command (USATECOM) at White Sands Missile Range (WSMR), New Mexico and Fort Benning, Georgia from January through November 1972 using hard tooled preproduction rounds. No deficiencies were found in the tactical weapon system (round and tracker). Reliability deficiencies were found in the Launch Effects Trainer (LET) (training equipment).
- d. No specific DT III was planned because no deficiencies were found in the hard tooled tactical system during DT II. However, during the Launch Effects Trainer Check and Operational Test conducted during April through December 1973, it was determined that a DT III would be conducted on the LET. The purpose of the DT III was to verify that the reliability, availability, maintainability (RAM) problems encountered during the LET Check and Operational Test had been corrected and to evaluate the training value of a modified LET. The test was conducted during August through October 1974 at Fort Benning, Georgia, by US Army Infantry Board and validated that the RAM problems had been corrected and that the modified LET was not as good a trainer as the standard LET.
- e. Arctic environmental tests were conducted at the Arctic Test Center from October 1972 through March 1973. Tropic Testing was conducted at the Tropic Test Center, Panama, from January 1974 through December 1974. No problems were encountered in either test that would indicate that DRAGON performance would be degraded in an arctic or tropic environment.

Budget Activity #4 - Tactical Programs

Program Element #2.37.27.A

Title Medium Antitank Assault Weapon (DRAGON)

f. The original DT II of the interim DRAGON night sight, AN/TAS-3, was reduced in scope to the minimum essential to support a limited procurement. The reduced testing resulted from actions to redirect development in order to provide greater commonality in night sights. Therefore, DT II for DRAGON night sight was limited to temperate testing at White Sands Missile Range, New Mexico; Fort Benning, Georgia; and Fort Bragg, North Carolina during the period May 1973 through February 1974.

g. The DRAGON Night Sight (AN/TAS-5), a member of the manportable common thermal night sight program (MCTNS), was evaluated in a DT I during March - June 1975, as a basis for selection of the DT/OT II prototypes. Although the basic thermal sights exceeded the required specification, an interface problem between the thermal sight and DRAGON missile tracker resulted in excessive bore-sight displacement. A redesign of the mounting bracket was accomplished. Although tests confirmed the AN/TAS-5 remounting was successful, the mount was heavy and therefore, an integrated night tracker (INT) was designed and evaluated. Government Engineering Design Test I of the INT was conducted in June 1976 at MCOM and resulted in:

The INT continues in development. DT II is scheduled to be conducted by TECOM at WSMR from November 1977 to January 1978.

h. At the request of Training and Doctrine Command (TRADOC) and United States Army Infantry School, the Human Engineering Laboratory developed a mount for DRAGON incorporating a viscous damped device to increase DRAGON utility on the Armored Personnel Carrier and from the standard machinegun tripod mount for use with Mechanized Infantry. Concept evaluation tests investigated employing DRAGON with the Viscous Damped Mount (VDM). The results of these tests indicate the VDM has the potential of increasing the DRAGON hit probability when used. DT III, to evaluate production models of the VDM, is scheduled April - May 1978.

i. A tabulation of DRAGON test missile firings follows:

| Test Program                     | Summary of Test Firings |      |                      |
|----------------------------------|-------------------------|------|----------------------|
|                                  | Launches                | Hits | "No" Test Functional |
| Prototype Flt                    |                         |      |                      |
| Evaluation Test 1/               |                         |      |                      |
| Engineering Test (DT II)         |                         |      |                      |
| Expanded Service Test (DT/OT II) |                         |      |                      |
| Temperature                      |                         |      |                      |
| Arctic                           |                         |      |                      |



Budget Activity #4 - Tactical Programs

Program Element #2.37.27.A

Medium Antitank Assault Weapon (DRAGON)

| Title   |                   |
|---|-------------------|
| Tropic  | Jan 1974-Dec 1974 |
| Tactical Effectiveness Testing of Antitank Missiles (TETAM)                           | May 1973          |
| Night Vision Sight (AN/TAS-3) DT II (Engineering Phase)                               | Jul 1973-Jan 1974 |
| Launch Effects Check Test/OT  | Sep 1973-Dec 1973 |
| Launch Effects Trainer  |                   |
| DT III  | Aug 1974-Oct 1974 |
| OT III  | Aug 1974-Oct 1974 |
| Night Sight (AN/TAS-3) OT II  | Apr 1974-May 1974 |
| Night Sight (AN/TAS-5) DT I   | Mar 1975-Jun 1975 |
| Viscous Damped Mount  | Mar 1975          |
| OT III a  | 29 Oct-9 Dec 1975 |
| Night Fighting Test:<br>Bolt-on Thermal Night Sight<br>Integrated Night Tracker (INT) | 4 Jun-11 Jun 76   |
| Engineering Design Test I   | 10 Jun-24 Jun 76  |
| TOTALS  | 8/                |

NOTES:

1/ Configuration of these rounds was essentially the same as the current Technical Data Package (TDP). However, quality screening and testing added to the TDP prior to the test did not begin to mature until ET/ST hardware was built.

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Title Medium Antitank Assault Weapon (DRAGON)

- 2/ firings were attempted at temperature below the required lower limit of -25 degrees F. firing test set-LP deficiency.  
3/ Involved night sight failure.  
4/ tracker and missile failures of varying types.  
5/ failures because of various tracker and missile malfunctions. Bolt-on "no test" caused when night sight objective lens fell out.  
6/ The INT "no test" was caused by gunner error.  
7/  
8/ Annual Service Practice (ASP) results, which are not test results, were eliminated from this summary.

2. Operational Test and Evaluation:

- a. The plans for combined Engineer Test/Expanded Service Test (ET/ST) were prepared by Army Test and Evaluation Command and Combat Developments Command (CDC) working jointly so that the combined test could provide both the development evaluation data required by TECOM and the operational data needed by CDC. CDC, the independent test agency (at that time), provided test control personnel during the test and submitted an independent test report.
- b. The temperate phase of the ET/ST was conducted by typical military personnel supported by a mechanized infantry platoon at Ft Benning, Georgia, from March to September 1972. Hardware was produced from a pilot production line and was identical to full production items with the exception of minor modifications made to correct deficiencies and shortcomings found during the test. Two hundred twenty-one missiles were fired, of which 76 were used for training, 126 were used during the field evaluation phase, and 19 were used for countermeasures testing. Eight trackers were used. During the field evaluation phase, firings were conducted using various simulated combat scenarios. During ET/ST no deficiencies were found in the basic tactical system (tracker and round) or in the test set. The hit and kill probabilities achieved for DRAGON during OT demonstrated a significant improvement over the medium antitank weapon M67 90mm Recoilless Rifle. Reliability problems with the launch effects trainer (LET) and low gunner accuracy (hit probability) during tactical missile firings required modifications to provide acceptable reliability and more realistic missile launch effects to the trainer. Revised training procedures were examined to improve gunner accuracy.
- c. The check/operational test of DRAGON training equipment was conducted by OTEA at Ft Benning, Georgia, from May through October 1973. Typical infantry personnel were involved in the testing of the LET. Test objectives were to verify the correction of deficiencies found during DRAGON ET/ST and to validate the training program and training equipment. Testing involved 194 production missiles. The LET check/operational test was a combined DT/OT. OTEA provided evaluation personnel and submitted an independent evaluation in April 1974.
- d. OT III was conducted by MASSTER (now TCATA) under the direction of OTEA at Ft Hood, Texas, during the period September - October 1974. OT III utilized a mechanized infantry battalion task force. Two hundred and four production missiles were fired during OT III. The independent evaluation of the DRAGON was prepared and submitted by OTEA. As a result of the DRAGON ASARC/DSARC IIIa (June - July 1975), the Army was directed by OSD to conduct additional testing of the DRAGON system to assess the validity of

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the logistical support concept, adequacy of the design changes to the DRAGON tracker, and to investigate the minimum effective range capability of DRAGON. DRAGON OT IIA was conducted at Ft Bragg, North Carolina, during November - December 1975. The test reinforced the need to improve the DRAGON logistic concept, and TRADOC proposed changes to improve the logistic system. Improved training techniques significantly upgraded hit performance, and the test showed DRAGON's ability to hit at short ranges to be consistent with its probability of hit ( $P_h$ ) at greater ranges. Total test results: Thus, the tests showed the design modifications to be effective.

e. The DRAGON night sight is a separate program with separate testing. OT II for an interim Night Sight (AN/TAS-3) was conducted by OTEA at Hohenfels, Germany, March - May 1974 utilizing a mechanized infantry company reinforced with a TOW section. The independent evaluation concluded that, "The AN/TAS-3 Night Sight provides a night firing capability for antitank guided missiles of the DRAGON/TOW class that does not presently exist and may provide an advantage over the day sight used with illumination when smoke, fog, or haze are present on the battlefield. Realization of this performance capability will entail the acceptance of unique logistical requirements for batteries, freon bottles and their respective charging fixtures." Based on troop participation and observation of the test and test results, US Army Europe recommended that the DRAGON Night Sight (AN/TAS-3) not be procured. The Army Materiel Development Acceptance In-Process Review, held 30 October 1974, recommended that the interim DRAGON Night Sight (AN/TAS-3) not be type classified; that accumulated data be retained and utilized in related development; and that the technical data package be completed and retained. The current version of the night vision device for the system is the DRAGON Integrated Night Tracker (INT) that combines the infra-red tracking components of the day tracker and the thermal imaging components of the MCINS family into a single housing. However, the visual scene presented with the INT is still a thermal image. The original DRAGON night sight in the MCINS program was a separate thermal sight that mated to the day tracker in a "bolt-on" fashion. Interfacing and boresight retention problems were initially experienced during research development acceptance testing and limited operational testing, but were resolved by DRAGON Night Sight OT Ia follow-on evaluation during April - May 1976. Additionally, the DRAGON Night Sight demonstrated operationally acceptable performance in the night fighting test. However, the DRAGON Night Sight/DRAGON Day Tracker combination was still overweight. Under the auspices of DRAGON Project Manager the Texas Instrument Company built the INT as a solution to the interface and weight problem. This INT demonstrated feasibility by achieving of DRAGON in the night fighting test at Ft Knox in addition to during Government Engineering Design Tests during June at Redstone Arsenal. An INT OT I was conducted by OTEA at Ft Benning, Georgia, from October - December 1976 to obtain data to assess the night and obscured conditions capability of the DRAGON with the INT as compared to the AN/TAS-5 bolt-on sight. The results, not yet available, will provide the basis for continued engineering development. OTEA is scheduled to conduct OT II from December 1977 to February 1978 at a location yet to be determined.

f. OT II for the Viscous Damped Mount will be conducted by TRADOC at Fort Benning, Georgia, from January - February 1977.

# Budget Activity #4 - Tactical Programs

Program Element #2.37.27.A

Title Medium Antitank Assault Weapon (DRAGON)

Operational/Technical  
Characteristics

Range

Maximum  
Minimum

System Reliability

Single Shot Kill Probability (SSKP)

Stationary Target  
Moving Target

Probability of a Hit ( $P_h/R$ )

Stationary Target  
Moving Target

Probability of a Kill Given a Hit ( $P_k/H$ )

Stationary Target  
Moving Target

System Weight

Objectives

1000M

.95

.90 1/ 4/

2/ 4/  
2/ 4/

2/  
2/

2/  
2/

30.9 pounds 3/

30.9 pounds 3/

1/ System reliability is .90, which is two points below the DCP threshold (.92). Reliability degradation is attributed to the round caused by workmanship problems during manufacturing, less than desirable process controls, and miscellaneous hardware problems. Corrective actions, including improved training, tighter process controls, increased inspections and tests, and hardware changes have been implemented to correct production quality problems as well as round reliability problems, and will significantly reduce round failure rate. System reliability was calculated using 3199 firings since beginning of the ET/ST program. System reliability based on operational testing and annual service practice has averaged  $P_k/H$  decreased because system reliability decreased.  $SSKP = Reliability \times P_h/R \times P_k/H$ .

2/  $P_k/H$  decreased because system reliability decreased.

3/ Ready to fire weight.

4/ Corrective actions to improve tracker reliability have been implemented and tested. See paragraph 2d above.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #2.37.30.A

Title CHAPARRAL

Category Operational System Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                            | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|----------------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT        | 4890    | 6011    | 5229    | 600     | 0                        | 85840                |
|                | Quantities                       |         |         |         |         |                          | Not Applicable       |
| Procurement:   | CHAPARRAL Funds                  | 37300   | 61400   | 49900   | 0       | 7400                     | 456700               |
|                | Funds (Modifications)            | 0       | 2200    | 14300   | 4600    | 0                        | 50100                |
|                | Quantities (Missiles/Fire Units) | 0/52    | 0/0     | 2000/0  |         |                          |                      |

BRIEF DESCRIPTION OF ELEMENT: This program provides for development and procurement of missiles, ground support equipment, and system improvements for the CHAPARRAL air defense missile system. This program was reported in the FY 1977 budget as a part of the CHAPARRAL/VULCAN Composite Program Element 2.37.32.A.

BASIS FOR FY 1978 RDTE REQUEST: Funds are required to continue developmental work on system improvements, including work on a smokeless missile motor and adaptation of the STINGER System's Identification Friend or Foe (IFF) components to the CHAPARRAL fire unit. Additionally, funds are required to complete an adverse weather CHAPARRAL demonstration effort initiated in FY 1977 in accordance with Congressional direction.



Budget Activity #4 - Tactical Programs

Program Element #2.27.30.A Title CHAPARRAL

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Three million dollars of amount approved for CHAPARRAL for FY 1977 was directed by Congress to be spent on the demonstration of an adverse weather CHAPARRAL. The balance, slightly over \$3.0M, was allocated by the Army to the developmental work required for a smokeless missile motor and adaptation of the STINGER system Identification Friend or Foe (IFF) components to CHAPARRAL. The FY 1978 request represents a slight decrease from FY 1977. The decrease is a result of a planned decrease in program scope resulting from the following: expected completion of the developmental work on the IFF; expected completion of the adverse weather effort and expected completion of the development of the smokeless motor except for wrap-up tasks.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL | FY 1977 and Prior | FY 1978 | Total |
|----------------------------|------|-------------|-------|-------------------|---------|-------|
| (1) Federal Civ. Employees | 23   | 0           | 23    | 80000             | 500     | 80500 |
| (2) Contractor Employees   | 26   | 1010        | 1036  |                   |         |       |
| TOTAL                      | 49   | 1010        | 1059  |                   |         |       |

TERMINATION COST: (\$ in Thousands)

DETAILED BACKGROUND AND DESCRIPTION: In November 1964, the Secretary of Defense directed the initiation of a development program for an interim air defense system to provide low altitude, fair weather, air defense protection in the forward areas of the theater army. Existing missile systems such as HAWK were too large and expensive to provide the mobility and proliferation required to counter modern fighter aircraft using very low altitude attack techniques. A combination missile/gun defense was determined to be the optimum means of meeting the requirement. The CHAPARRAL and VULCAN air defense systems were developed and fielded as composite battalions. CHAPARRAL/VULCAN battalions are currently authorized in all US Army divisions, except airborne and airmobile, which only have VULCAN. Additional nondivisional battalions have the mission of protecting selected targets in the rear areas, such as airfields and vital installations. CHAPARRAL is a self-propelled, short range, air defense missile system. The system consists of the CHAPARRAL MIM-72A missile (an adaptation of the Navy Sidewinder 1C air-to-air missile), the M54 guided missile launching station, the M730 tracked carrier vehicle and appropriate communication, maintenance and test equipment. The MIM-72A missile is a supersonic fire and forget missile which employs passive infrared homing guidance. Four missiles are carried on launch rails in ready-to-fire configuration and eight additional missiles are carried in the storage compartments of the carrier. (An Improved CHAPARRAL missile, MIM-72C, incorporating significant improvements to the basic MIM-72A missile has been developed and is scheduled to be fielded in --

The M54 launching station is a moveable turret with supporting base

**Budget Activity #4 - Tactical Programs**

Program Element #2.37.30.A

Title CHAPARRAL

structure which provides the gunner with full capability for aiming and firing the missiles. It is normally mounted on the M730 carrier but can be removed and operated from a ground emplacement. Mobility is provided by the M730 full-tracked vehicle, which provides excellent crosscountry mobility. This vehicle is capable of swimming. The CHAPARRAL crew consists of a gunner and four gunner/observers. Identification is visual. The forward area alerting radar (FARR) which provides alerting and tentative identification data on aircraft to ranges of 20KM is also funded under the CHAPARRAL program element. A FAAR platoon is authorized for each CHAPARRAL/VULCAN battalion. Alerting data are received on portable target alerting data display sets (TADDS) authorized for CHAPARRAL/VULCAN fire units and Redeye teams.

**RELATED ACTIVITIES:** VULCAN (Program Element 2.37.32.A), Advanced Forward Area Air Defense System (Program Element 6.33.01.A), ROLAND (Program Element 6.43.09.A) and STINGER (Program Element 6.43.06.A) are considered complementary programs. Duplication of efforts being pursued by other services is avoided by continuous CHAPARRAL project office coordination with the Naval Weapons Center, China Lake, California, developer of the Sidewinder IC and the MIM-72A CHAPARRAL, and by continuous project office contact with the US Army Missile Research and Development Command Laboratories which monitor Tri-Service programs. Project office personnel and Headquarters Department of the Army System Coordinators routinely contact other service project offices and staff agencies on planned efforts.

**WORK PERFORMED BY:** The CHAPARRAL ground support equipment is contracted through US Army Missile Research and Development Command, Huntsville, Alabama, to Ford Aerospace and Communications Corporation (Formerly Aeronutronic Ford), Newport Beach, California. The basic CHAPARRAL missile (MIM-72A), less guidance section, was procured by Military Interdepartmental Procurement Request (MIPR) through the Navy. The guidance section was contracted to Raytheon, Bedford, Massachusetts. The Improved CHAPARRAL Missile (MIM-72C) is contracted through US Army Missile Research and Development Command to Ford Aerospace. The contractor for the CHAPARRAL carrier, M730, is the FMC Corporation, San Jose, California. The Forward Area Alerting Radar (FAAR) was contracted to Sanders Associates, Inc., Bedford, Massachusetts for the first procurement and to Sperry, Gyroscopic Division, Great Neck, New York, for the second procurement.

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. FY 1971, FY 1976, and Prior Accomplishments: CHAPARRAL development began in FY 1965. Existing hardware was used to the maximum extent in order to reduce development time and cost. Initially, testing established the technical feasibility of using the Navy's Sidewinder IC missile, modified for ground-to-air use, with a modified M548 Logistics vehicle as its carrier. Limited production (LP) was approved for the CHAPARRAL missile in September 1965 and for the CHAPARRAL fire unit in November 1965. The first CHAPARRAL unit was activated in January 1969, and the system was type classified in November 1970. The system was fielded with certain recognized inherent limitations and priorities were established for improvements. A product improvement program to provide CHAPARRAL with a forward hemisphere capability, a new fuze and an improved warhead was completed and an Improved CHAPARRAL missile (MIM-72C) incorporating these improvements was type classified

**Budget Activity #4 - Tactical Programs**

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Title CHAPARRAL

standard November 1974. This improved missile is in production and is scheduled to be fielded in 1975. A program to develop a prototype target acquisition aid (TAA) which would permit CHAPARRAL to engage target under nighttime/reduced visibility condition was completed in December 1974. However, the TAA has not been adopted due to cost and complexity. An in-depth study of the limitations of the improved missile was made in 1974. In 1975 the US Army Missile Research and Development Command conceived and evaluated the "Golden" seeker which promised to provide the improved missile with a capability both quicker and cheaper than the techniques identified in the study. The US Army Missile Research and Development Command in conjunction with the contractor validated and finalized the "Golden" seeker design, and this seeker is being incorporated into the improved missile currently in production. Work on an optimized version of the "Golden" seeker was initiated in April 1976. This improvement is scheduled to be incorporated in the missile buy. An effort was initiated in November 1975 to develop a smokeless missile motor which will reduce gunner smoke obscuration when the missile is fired and also reduce the battlefield signature of the system. The smokeless missile motor effort is currently on schedule and within budget. Nine successful static firings were completed in FY 1976 and FY 1977. These firings demonstrated that the smokeless motor meets the performance requirements of the CHAPARRAL at both the low and high temperature extremes. A development effort was initiated in June 1975 to adapt the major components of the STINGER Identification Friend or Foe device to the CHAPARRAL fire unit. Like the smokeless motor, this effort is also on schedule and within budget. CHAPARRAL/STINGER Identification Friend or Foe components were successfully integrated by the contractor during FY 1976 and FY 1977, and performance objectives were achieved in road, environmental, subsystem performance and antenna pattern tests. A developmental effort was initiated in January 1976 to reduce sun glint from the fire unit canopy. This effort was terminated in FY 1977 after extensive testing showed that the problem was not as severe as originally believed. Work commenced on the Forward Area Alerting Radar (FAAR) in May 1966, with the first prototype being delivered in March 1968. The FAAR was initially approved for Limited Production (LP) in October 1968. Approval for LP was rescinded in March 1969 because of equipment deficiencies. Following modification and test the system was returned to LP status, and approved for full production in April 1971. The first nine FAAR platoons were deployed beginning December 1972, and the FAAR was type classified standard in 3rd Qtr, FY 1973. The second procurement of FAAR to complete the fill of active Army units was approved and the contract was let in May 1974.

2. FY 1977 Program: Developmental work on the smokeless missile motor and adaptation of the STINGER IFF device to the CHAPARRAL fire unit will continue in FY 1977. The smokeless motor effort will involve contractor and government portions. The contractor portion will be oriented toward validating motor design and will encompass flight weight tailoring, environmental testing, design verification and failure mode and effects analysis. The government portion will be directed toward verifying the reliability, safety and performance characteristics of the motor under static and flight conditions and will determine whether or not the motor is suitable for use. Work on the IFF includes completion of qualification testing by the contractor and conduct of a two-phase product improvement test by the government. The product improvement test will determine whether or not the IFF subsystems perform in accordance with the specifications under field conditions using troops. A production decision is planned for the IFF by fourth quarter FY 1977. In addition to the smokeless missile motor and IFF efforts, an adverse weather CHAPARRAL demonstration

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Title CHAPARRAL

will be initiated in accordance with Congressional direction. This effort, which will require approximately 18 months to complete, will involve a minimum of four missile flights. Funding in FY 1977 and FY 1978 will be required.

3. FY 1978 Planned Program: The developmental work on the smokeless missile motor and adaptation of the STINGER IFF device will continue in FY 1978, as will the adverse weather CHAPARRAL demonstration effort. Contractor and Government portions are included in each effort. The smokeless motor contractor portion will be oriented toward optimizing and finalizing the motor design and delivery of test motors to the government. The government portion, which will be the major portion, will focus on testing. The smokeless motor development will be completed in FY 1978 except for minor wrap-up tasks. The smokeless motor is currently funded for procurement in to replace existing motors as they reach shelf-life expiration. The contractor portion of the IFF effort includes fabrication, test and certification of special acceptance inspection equipment; finalization of a required report; and continuing support to the government for completion of the government's test report. The government portion includes preparation of a test report, and depot refurbishment of the fire unit, test equipment and training equipment utilized for testing. Development of the IFF will be completed in FY 1978 and procurement will be initiated. The FY 1978 adverse weather contractor portion includes the continuation of tasks started in FY 1977 concerning hardware modifications, system engineering/analysis/integration, computer simulation. Continuing management and submission of a final report are also part of the FY 1978 contractor effort. The government portion includes tasks/costs associated with the missile flights, government furnished equipment, concept evaluation and analysis, government support services, and management.

4. FY 1979 Planned Program: Wrap-up tasks associated with the smokeless missile motor development will be performed.

5. Program to Completion: No work remains to be completed after FY 1979.

6. Major Milestones: The next major milestone for CHAPARRAL is projected for early CY            At that time, the US ROLAND Missile System is scheduled for distribution to non-divisional active forces and CHAPARRAL assets will be phased into the Reserve Components.



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Title CHAPARRAL

TEST AND EVALUATION DATA:

1. Development, Test, and Evaluation:

a. The development contractor for CHAPARRAL was Ford Aerospace and Communications Corporation (formerly Aeronutronic Ford) Newport Beach, California. The US Naval Weapons Center, China Lake, California, performed redesign, modification and evaluation of the SIDEWINDER IC missile for use in the CHAPARRAL program. CHAPARRAL is a clear weather, passive infrared homing air defense missile system which provides low altitude air defense for the division and selected activities/installations in the Corps rear. The currently fielded version consists of the MIN-72A CHAPARRAL missile (SIDEWINDER adaptation), the M54 guided missile launching station, the M730 tracked vehicle carrier and appropriate communications, maintenance and test equipment. The system requires a crew of five and visual target identification. The system carries 12 missiles, four on launch rails and eight in storage compartments. An improved CHAPARRAL missile, MIN-72C, is currently in production. This missile, scheduled for fielding in a new AN/DAM-1 guidance section, a new directional doppler (DIDO) tube and a new blast fragmentation warhead. The missile has an all-aspect engagement capability and some

Engineering Design/Military Potential testing of CHAPARRAL was conducted in the period March 1965 to August 1965. Based on the favorable results of those tests, limited production (LP) type classification was approved in September 1965 for the basic CHAPARRAL missile and in November 1965 for the ground equipment. Engineering Test (ET) and Service Test (ST) were initiated in May 1967 and the major portions had been completed by March 1969. A portion of an Initial Production Test (IPT) was integrated with ST and completed therewith. The remainder was assigned to the ET agency and completed in January 1970. As a result of ET/ST/IPT the system was found suitable for Army use and issue provided system effectiveness, maintainability and inner boundary criteria were waived and provided three deficiencies noted (canard shear pin failures, trigger assembly failures and AN/DSM-79 missile test set reliability) were corrected. Follow-on tests verified correction of the shear pin problem. Tropic environment tests were conducted from July 1968 to September 1969 and Arctic environment tests were conducted from October 1969 to February 1970. These tests resulted in no substantive change in the Army's position concerning the system's suitability for use and issue. The CHAPARRAL system was type classified standard in November 1970 with waivers and a recommendation for an expedited product improvement program. Hardware used for the foregoing tests included prototype, engineering and early production models.

b. Prototype and Engineering Tests of the Improved CHAPARRAL missile, MIN-72C, were conducted from May 1971 through July 1973, of 11 firings were successful. Of which were contact hits on the target. One unsuccessful firing was the result of random component failure and the other was the result of a readily corrected design deficiency. Developmental testing (DI II) was conducted from November 1973 through December 1974. The missile tested was essentially the same as the one procured. Reliability, availability and maintainability characteristics of the improved missile equalled or exceeded that of the basic missile.



Budget Activity #4 - Tactical Programs

Program Element #2.37.30.A

Title CHAPARRAL

c. The AN/DAM-1 Guidance Section for the improved missile remained "Golden" was developed and tested from January to December 1973. This fix demonstrated a capability, and a fix designated capability. The "Golden" fix has been incorporated into the Improved CHAPARRAL missiles that are in production.

d. Standard quality assurance initial production testing will be conducted on the production configuration Improved CHAPARRAL missiles.

e. The Forward Area Alerting Radar (FAAR) is a lightweight, short range, highly mobile, low-cost radar system with the capability of detecting, locating and tentatively identifying low to high speed aircraft in heavy clutter environments. This system is organic to each division. Target information in the form of range, azimuth and identification (friend or foe) is transmitted from the radar to the CHAPARRAL, VULCAN and REDEYE fire units. Engineering Design Tests (ED) were conducted on FAAR during the period April 1967 to October 1968. Type classification Limited Production (LP) was awarded upon completion of ED. System Acceptance Tests and Engineering Service Tests were completed in February 1968 and April 1968 respectively. Engineering Test (ET) and Service Test (ST) began in March 1968 and May 1968 respectively. These tests were suspended in March 1969 due to numerous equipment deficiencies. The LP type classification was rescinded as a result. In January 1970, a special FAAR demonstration test was conducted for a special panel appointed by the Commanding General, Army Materiel Command (now Materiel Development and Readiness Command). This demonstration resulted in FAAR being returned to LP type classification status. An acceptance test was conducted at the contractor plant in October and November 1970. Preproduction testing was conducted in November and December 1970. ET and ST resumed in January 1971. ST was completed in July 1971 and ET in September 1971. Initial production tests were conducted from December 1971 through August 1972. These tests resulted in the FAAR being type classified standard in February 1973. Additional testing has included a tropic test conducted from June through December 1973 and a Special Evaluation (SE), Phase I test, conducted at Modern Army Selected Systems Test and Evaluation Review (MASSTER), Fort Hood, TX, in November and December 1973. A cold weather test was conducted in the environmental chamber at White Sands Missile Range, NM, from March through July 1975.

2. Operational Test and Evaluation

a. The Operational Test and Evaluation Agency (OTEA) conducted Operational Test II (OTII) of the MIN-72C Improved missile in two phases with troops, a nonfiring phase at Ft. Lewis, WA, in February 1974 and a firing phase at Ft. Bliss, TX, in March 1974. The firing phase was planned to consist of 14 firings. Of the first firings, resulted in contact hits on the target and sufficient data had been generated to satisfy test objectives. Because of this, further operational testing was not required. An independent evaluation was prepared and submitted by OTEA.

Budget Activity #4 - Tactical Programs

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Title CHAPARRAL

b. Forward Area Alerting Radar (FAAR): Phase II of the Special Evaluation (SE) test was completed by the Operational Test and Evaluation Agency (OTEA) at Ft. Lewis, WA, during February 1974. The results of Phase I and Phase II were briefed to the Director, Defense Research and Engineering on April 5, 1974. Based on these actions, procurement of sufficient FAAR systems to satisfy Active Army requirements was authorized.

3. System Characteristics:

a. CHAPARRAL

| OPERATIONAL/TECHNICAL            | OBJECTIVE   | DEMONSTRATED 1/ | COMMENTS |
|----------------------------------|---|-----------------|----------|
| Mobility and Transportability    | Self-propelled 100 percent mobile; Capable of travel over rough terrain; transportable by rail, phase II air operations, highway and ship; move from beached craft to shore under own power; transport by helicopter. | Met             | NA       |
| Period of Operation              | Continuous for 18-hour day  | Met             | NA       |
| Mean Reaction Time               | —   | Met             | NA       |
| Launch Sequence                  | Less than —   | Met             | NA       |
| Energize System from Standby     | Less than —   | Met             | NA       |
| Crew Size                        | Operate by one man; 5 man crew  | Met             | NA       |
| Reload (rounds/minute)           | —   | Met             | NA       |
| Emplacement Time                 | — sec   | — min           | —        |
| Launching Station Weight (empty) | 10,000 lbs  | 8,726 lbs       | NA       |

# Budget Activity #4 - Tactical Programs

| Program Element                                | #2.37.30.A  | Title                | CHAPARRAL  |
|--|---|----------------------|--|
| Minimum/Maximum Intercept Range                | MIN-72A:<br>MIN-72C:  | MIN-72A:<br>MIN-72C: | MIN-72A:<br>MIN-72C:   |
| Fuze   | Function within effective kill radius of warhead, function on contact and provide self-destruct |                      | 3/; Improved MIM-72C missiles that meet intercept range requirements to be fielded |
| Warhead  | Compatible with overall missile design criteria   |                      | 3/; Improved MIM-72C improved missile incorporating new fuze to be fielded in      |
| System Mean Effectiveness (Benign Environment) |   |                      | 3/; Improved MIM-72C missile with blast fragmentation warhead to be fielded in     |
| Accuracy                                       |   |                      | NA   |
| Successful Intercepts                          | Not specified   |                      | 3/   |
| Direct Hits                                    |   |                      | NA   |
|  |   |                      | 3/   |

Budget Activity #4 - Tactical Programs

Program Element #2.37.30.A

Title CHAPARRAL

b. Forward Area Alerting Radar (FAAR)

Probability of Detection

Range

1-20 km

Elevation

Altitude

@ max range

Emplacement

20 min

March Order

15 min

Frequency

Not specified

Scan Rate

30 RPM

Radar Mean Time Between Failures

hrs

- 1/ During Engineering Test, Service Test, Initial Production Test and User Training Tests.
- 2/ Includes times to send out observers and establish communications with them.
- 3/ Demonstrated during Prototype, Engineering and DT II/OT II of Improved missile.
- 4/ Based on Product Assurance Quarterly Reliability Report 1st Qtr FY 75.

NA  
NA  
NA  
NA  
NA  
NA  
NA  
NA  
NA  
4/

# FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #2.37.31.A

Category Operational Systems Development

Title Surface-to-Air Missile HAWK/HIP

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number   | Title  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|--|--|---------|---------|---------|---------|--------------------------|----------------------|
|  | TOTAL FOR PROGRAM ELEMENT Quantities (Msls/GSE Sets) | 14922   | 3117    | 12538   | 18445   | 40149                    | 225993               |
|  |  | 0/0     | 0/0     | 0/0     | 0/0     | 0/0                      | 55/2                 |
| D690   | SAM HAWK/HIP Quantities                              | 14922   | 3117    | 12538   | 18445   | 40149                    | 225993               |
|  |  | 0/0     | 0/0     | 0/0     | 0/0     | 0/0                      | 55/2                 |
| Procurement:   | Funds  |         |         |         |         |                          |                      |
|  | Quantities   | 71800   | 0       | 93300   | 71600   | 71300                    | 990800               |
|  |  | 520/3   | 0/0     | 509/6   | 608/0   |                          |                      |
| Military Construction:   |  | 0       | 0       | 0       | 0       |                          |                      |
| BRIEF DESCRIPTION OF ELEMENT: Development work in this program is to upgrade Improved HAWK system effectiveness, maintainability, and survivability to meet the projected threat into the 1980's.            |  |         |         |         |         |                          |                      |
| BASIS FOR FY 1978 RDTE REQUEST: To continue development of countermeasures and mobility improvements to maintain system effectiveness and survivability.   |  |         |         |         |         |                          |                      |
| BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Decrease is due to a reevaluation of the magnitude of the improvement effort and projected completion of development work on five product improvements in FY 1977. |  |         |         |         |         |                          |                      |
|  |  |         |         |         |         |                          | electronic counter-  |



Budget Activity #4 - Tactical Programs

Program Element #2.37.31.A

Title Surface-to-Air Missile HAWK/HIP

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |                       |        |        |
|----------------------------|------|-------------|-------|-----------------------|--------|--------|
| (1) Federal Civ. Employees | 7    | 0           | 7     |                       |        |        |
| (2) Contractor Employees   | 195  | 507         | 702   | (1) Estimated Govern- |        |        |
|                            |      |             |       | ment Liability        |        |        |
|                            |      |             |       | Financed with:        | 154070 | 0      |
| Total                      | 202  | 507         | 709   |                       |        | 154070 |

TERMINATION COST: (\$ in Thousands)

FY 1977  
and  
Prior

FY 1978  
Total

DETAILED BACKGROUND AND DESCRIPTION: Technical assessments and operational testing confirmed the HAWK missile, its marginal performance against bomber threats until replaced by PATRIOT. The HAWK Improvement Program (HIP) was initiated in 1964 to meet the Soviet high performance fighter and light new all solid state guidance package was designed with the intent to counter the especially responsive missile for effective one-third more weight, has been added to the missile for marked gain in lethality. A new rocket motor increases the range, speed, and altitude of the HAWK missile. A computer has been added to handle the entire radar detection-to-missile launch sequence with a corresponding percent reduction in reaction time. Modifications to the various radars and other ground support equipment have been developed to incorporate electronic warfare countermeasures and built-in test equipment and to achieve compatibility with the new missile and computer.

RELATED ACTIVITIES: The US Marine Corps is actively participating in the HAWK Improvement Program. Program coordination is accomplished by exchange of technical reports and attendance at scientific meetings and conferences. The Identification Friend or Foe (IFF) System (AN/TPX-46) for HAWK is part of a National Defense Program. (Program Element #6.47.09.A, IFF Equipment.) The NATO HAWK Consortium, under the HAWK European Limited Improvement Program Agreement, contracted direct with US industry to convert their HAWK assets to the Improved System. Under the US-Japan Co-production Agreement, Japan is manufacturing Basic HAWK. Countries owning Basic HAWK assets have indicated interest in upgrading their Basic HAWK systems to the improved configuration. Many are already on contract for converting. Several countries which had no Basic HAWK are also on contract to buy the Improved HAWK.

WORK PERFORMED BY: The project is managed by the US Army Missile Research and Development Command (MIRADCOM), at Huntsville, Alabama. It is conducted by contract and in-house efforts. The prime contractor is Raytheon Company, West Andover, Massachusetts.

Budget Activity #4 - Tactical Programs

Program Element #2.37.31.A

Title Surface-to-Air Missile HAWK/HIP

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments:

The HAWK Improvement Program (HIP) was initiated in November 1964. Engineering development for the major improvements modification kits to the ground support equipment, new automatic data processor, and new missile was completed by the end of FY 1969. A "CORE" missile firing program in March-July 1970 demonstrated Improved HAWK's capability in areas where Basic HAWK has little or no capability. After a review of the CORE tests, fuze improvements were made and a Performance Demonstration Test as a part of Development Test III was conducted from January to April 1971 to demonstrate missile reliability and performance with initial production missiles. All seven performance objectives were met but the scored reliability failed to meet the desired goal. As a result, more stringent quality control measures were introduced and a Reliability Demonstration Test (RDT) was scheduled for August-September 1971. The RDT showed a reliability of 7 and led to subsequent system type classification Standard A in December 1971. The Secretary of Defense approved the Revised Program Memorandum on 10 January 1972 and the FY 1972 procurement contract was signed on 14 January 1972. A combined Development Test III/Operational Test III (DT III/OT III) was conducted from May through July 1972. Results of the DT III/OT III were a decision to field the system on schedule and to conduct additional tests of field handled missiles to provide a larger data base for determination of missile reliability. A Reliability Verification Test (RVT) was conducted during October 1972, concluding with the result that field handling has no significant effect on missile reliability. The FY 1973 contract for 732 missiles and 18 battery set modification kits was signed on 31 October 1972. The first battalion's formal Initial Operational Capability (IOC) was 10 November 1972. Testing of the Improved Platoon Command Post was completed and it was type classified Standard in March 1973. An ad hoc group of the Army Scientific Advisory Panel was formed to review the research and development program to increase missile capability against critically spaced multiple targets and targets executing precisely timed high-g maneuvers. The first flight test of the modifications-validations test series was fired on 17 August 1973. Upon successful completion of this part in December 1973, a second series of firings were conducted incorporating two additional modifications. The missile modification validation flight tests were successfully completed in July 1974 and approved for incorporation into missile production in August 1974. Retrofit of previously produced missiles was approved in September 1974. Work was performed on three product improvements: (1) the modulator oscillator; (2) a Digital Moving Target Indicator (DMTI)

and (3) the memory capacity of the automatic data processor in the Information Coordination Central will be increased. This latter improvement includes a digital computer-to-computer interface with the AN/TSQ-73 fire distribution system.

Continued developmental work on three improvements previously started:

(3) Increased memory for the automatic data processor and digital data link interface with the

Budget Activity #4 - Tactical Programs

Program Element #2.37.31.A

Title Surface-to-Air Missile Hawk/HIP

AN/TSQ-73 Fire Distribution System. Initiated development of an \_\_\_\_\_ and \_\_\_\_\_ for the Improved Pulse Acquisition Radar (IPAR) and an \_\_\_\_\_ to maintain effectiveness in an ECM environment.

2. FY 1977 Program: Will complete developmental work on five modifications: (1) increased memory for the automatic data processor and digital data link interface with the AN/TSQ-73 Fire Distribution System; (2) counter-countermeasures (ECCM) to include \_\_\_\_\_ and \_\_\_\_\_ for the missile. Efforts to increase system mobility through on launcher missile transport and independent orientation and alignment will be continued.
3. FY 1978 Planned Program: Continue developmental work on \_\_\_\_\_ for the missile in the ECCM field. Continue the mobility efforts of on launcher missile transport and independent orientation and alignment. Program decrease is due to a reevaluation of the magnitude of the improvement effort and projected completion of development work on five product improvements in FY 1977.
4. FY 1979 Planned Program: Continue ECCM developmental effort on the \_\_\_\_\_ and \_\_\_\_\_ alignment. Initiate \_\_\_\_\_ effort to improve system mobility. Initiate other ECCM efforts for the \_\_\_\_\_ effort and the mobility enhancement effort.
5. Program to Completion: Continued development of some \_\_\_\_\_ not completed earlier and investigation of means to improve system mobility will continue until 1980.

6. Major Milestones:

- a. Engineering Development Contract Awarded
- b. Initial Operational Capability
- c. Completion of FY 1978 Development Efforts

| Date   | Estimated RDTE Cost to Reach Events (Cumulative) |
|--------|--|
| Nov 64 | 0  |
| Nov 72 | \$97M  |
| Sep 78 | \$167M   |

Budget Activity #4 - Tactical Programs

Program Element #2.37.31.A

Title Surface-to-Air Missile HAWK/HIP

TEST AND EVALUATION DATA:

Development Test and Evaluation: The contractor is Raytheon Corporation, Andover, Massachusetts. The first phase of Army testing, Development Test II (DT II) (Engineering Test/Service Test), was initiated in January 1969. Of 16 flights, 6 were successful; 3 guided properly but had no fuze function and 7 were failures. The tests were suspended in December 1969 and a design audit committee was formed to evaluate the system design. The committee confirmed the soundness of the design and proposed a "core" firing program to demonstrate six improved HAWK performance objectives against which basic HAWK has little or no capability. The core tests took place from March 1970 to July 1970. The six core objectives were:

After a review of the core tests, fuze improvements were made and a performance demonstration test (PDT) was conducted from January 1971 to April 1971. Of 18 shots, 17 were successful, 1 was a failure and 1 was a dud. All seven performance objectives (similar to the six core objectives) were met and the fuze modifications confirmed, but the missile reliability was below that required. As a result of PDT positive actions were taken to increase the contractor's quality control procedures and a reliability demonstration test was conducted in August through September 1971. This series of 18 scoreable flights showed a point reliability of 100%. DT III (Initial Production Tests) were conducted from May 1971 through November 1972. Over 30 missiles were fired in this program demonstrating improved HAWK's capability against various objectives, many of which were to determine the extremes of the envelope in range and target g's. These include testing of electronic countermeasures, minimum and maximum range, maximum altitude, maneuvering targets, multiple targets and hot and cold temperature environments. Missile reliability of all these different tests was 100%. As a result of these tests all missile requirements were met but an agreement was made to further investigate the possibility of improving performance against multiple and maneuvering targets. Three test missiles were modified. On 30 August 1972, the first missile successfully intercepted a target which had executed a escape maneuver; even though the missile scored a direct hit some anomalies were noted. Engineering changes were incorporated into the second missile and flown 13 April 1973 with unsuccessful results. The third missile incorporating a new error multiplier and rear wing attach fitting was fired on 6 June 1973 against the same multiple target parameters as the previous flight and was fully successful. In May 1973, an Army Scientific Advisory Panel (ASAP) ad hoc group was established to investigate missile structural breakup which had sometimes occurred during firings against multiple and maneuvering targets. In June 1973 the ASAP recommended four design changes. In July 1973 the Army proposed to Director of Defense Research and Engineering (DDRE) that a ten missile flight test program be undertaken to validate the modifications proposed by the ad hoc group as well as three additional modifications proposed by the Army. The first and second flight tests of this series were fired in August 1973. The ad hoc group met again and recommended a two part program. The first part of the program included only the four previously recommended modifications. These flights were completed successfully in December 1973. The second part of the program included two additional modifications and was successfully completed in July 1974. The six modifications were approved for production and approved for retrofit into previously produced missiles. Computer simulations validated by the live firings indicate the



Budget Activity #4 - Tactical Programs

Program Element #2.37.31.A

Title Surface-to-Air Missile HAWK/HIP

modifications

above, a temperate zone Development Test III (DT III) was completed in November 1969 and an arctic zone DT II was completed in March 1974. A tropic zone DT II was completed in December 1973.

A tabulation of Improved HAWK missile firings as of 30 Sep 76 follows:

| SUMMARY OF TEST FIRINGS  |                      |                    |                     | Unsuccessful |         |
|--|----------------------|--------------------|---------------------|--------------|---------|
| Test Program   | Dates                | Attempted Firings/ | Successful Flights/ | Flights      | No Test |
| Engineer Design Test   | Aug 67-<br>Oct 68    | 25                 | 1                   | 1            |         |
| Engineering Test/Service Test  | Jan 69-<br>Dec 69    | 16                 | 6                   | 9            | 1       |
| Core   | Mar 70-<br>Jul 70    | 11                 |                     |              |         |
| Performance Demonstration Test   | Jan 71-<br>Apr 71    | 18                 |                     |              |         |
| Initial Production Test, Initial Operational Test, Reliability Verification Test | May 71-<br>Nov 72    | 36                 |                     |              |         |
| Reliability Demonstration  | Aug 71-<br>Sep 71    | 18                 |                     |              |         |
| Lot Acceptance Test  | May 72<br>Continuing | 77                 |                     |              |         |
| Missile Improvement Program  | Aug 72-<br>Jul 74    | 21                 |                     |              |         |



Budget Activity #4 - Tactical Programs

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Title Surface-to-Air Missile HAWK/HIP

|                         |        |     |  |
|-------------------------|--------|-----|--|
| Tropic Test             | Dec 73 | 2   |  |
| Arctic Test             | Jan 74 | 3   |  |
| Annual Service Practice | Mar 74 | 129 |  |

- 1/ Successful flights were those in which the test objectives were met.
- 2/ of these launches were in a tactical configuration and resulted in successful flights, failures, and no test.
- 3/ No missile improvement program test data was provided for successful/unsuccessful flights because these firings were of several different configurations to prove design changes; however, of the missiles fired during June and July 1954 in the configuration subsequently approved for production, were totally successful against

of these missiles did not fuze on the targets; however, analysis revealed the modifications to have been fully successful.

2. Operational Test and Evaluation:

The plans for combined Development Test III (DT III/OT III) (Initial Production Test (IPT)/Initial Operational Test and Evaluation (IOTE)) were prepared by Army Test and Evaluation Command (TECOM) and Combat Developments Command (CDC) working jointly so that the combined test could provide both the development evaluation data required by TECOM and the operational data needed by CDC. CDC, the independent test agency, provided test control personnel during the test and submitted an independent test report. The personnel conducting the OT III were typical military personnel from Battery A, 6th Battalion, 61st Artillery, stationed at Fort Bliss, TX. The test was conducted from May through July 1972 at McGregor Range, New Mexico. Realism was added to the test through a simulated tactical environment, round-the-clock operation of the equipment, 405 live aircraft tracks directed against the Improved HAWK battery, and live missile firings. The test results demonstrated that the Improved HAWK ground support equipment was significantly better than the basic HAWK equipment. As the military personnel gained functional experience in operating the ground support equipment they demonstrated proficiency by engaging successfully every live aircraft track directed against them. Thirty-seven minor deficiencies were discovered during the test. These minor deficiencies have been corrected. No major deficiencies were discovered during the test. Fight live missile firings were conducted during the test (six fiscal year 1969 and 2 fiscal year 1970 production missiles). Of the missiles were considered no test as their failure to intercept the target was attributable to faulty test procedures and not to operator or equipment failure. Of the remaining rounds fired, were missile reliability successes and were missile reliability failures. Of year 1969 and fiscal year 1970 missiles). The missile reliability failures indicated that normal handling by user troops under field conditions might adversely affect missile reliability. Combat Developments Command (CDC) concluded that additional testing of the Improved HAWK missile must be conducted to determine the effects of field handling on missile reliability.

Budget Activity #4 - Tactical Programs

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Title Surface-to-Air Missile HAWK/HIP

In response to the CDC recommendation, a missile reliability verification test was conducted to determine the effect of field handling on missile reliability. Twenty-four fiscal year 1970 missiles planned for subsequent issue to operational units were extensively field handled and then checked through a theater readiness monitoring facility at Red River Depot. Missiles successfully passed this test. Five of these missiles were then fired. All five successfully intercepted their targets, thus indicating that field handling has no adverse effect on missile reliability. An in-process review on 15-16 August 1972 directed immediate fielding of the system. The Improved HAWK system became operational in Europe on 10 November 1972. Initial reports indicated that the system was performing well in its operational environment. A follow-on evaluation of an operational Improved HAWK battalion deployed in Europe was conducted by the newly formed US Army Operational Test and Evaluation Agency (OTEA). The purpose of the evaluation was to ascertain that the deficiencies noted during the Initial Operational Test and Evaluation (IOTE) had been corrected and to examine those areas of operational nature that were impractical to fully observe during the IOTE. The evaluation was conducted in two phases during June and September 1973. In each phase, data on Reliability, Availability, and Maintainability (RAM), training, publications, organization and human factors were collected in addition to system operations. Operationally, Phase I consisted of observation of the battalion's participation in a NATO air defense exercise. Phase II was a unit dedicated exercise in which OTEA maintained positive control over both high performance aircraft and helicopter targets. Analysis indicated that the system performed extremely well in an operational environment against a realistic threat. Problems were noted in the areas of communications, Identification Friend or Foe (IFF), supply and generators. Improvements in all four problem areas have been effected. Three remaining communications matters were addressed by field modifications in 1975. The IFF maintenance matters were resolved by increasing the repair/conversion rate at the depot and establishing a contractor repair effort to repair unserviceable assets above depot capability. The supply status has improved as a result of intensive management of repair parts and the use of supply control studies. Procurement of repair parts has been expedited and the contractor procurement lead time in some cases has been reduced. Corrective actions in the power generation field have included the development of new operational procedures and hardware modifications and the procurement of additional generators. The most significant operational findings were that:

- (1) The system successfully engaged a \_\_\_\_\_ percentage of aircraft penetrating or simulating attacks upon a battery.
- (2) Pop-up aircraft initially detected in near proximity of a battery were \_\_\_\_\_ prior to overrun.
- (3) The Automatic Data Processor (ADP) and Improved Continuous Wave Acquisition Radar (ICWAR) combination in both automatic and normal operation
- (4)
- (5) Successful engagement of \_\_\_\_\_ aircraft in attack profile requires crews and system to be operating at maximum efficiency.

Budget Activity #4 - Tactical Programs

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Title Surface-to-Air Missile HAWK/HIP

Because the evaluation was conducted in the unit's operational locale, live firings were not conducted. Live firings were conducted by units during annual service practice.

### 3. System Characteristics

#### Operational/Technical Characteristics

Intercept Dead Zone (slant range-km)  
Max Intercept Range (slant range-km)  
Intercept Altitudes (km)

- a. Minimum
- b. Maximum

Target Speed Handling Capability (M/Sec)

- a. Minimum
- b. Maximum

Average Reaction Time (sec)  
Automatic Operation in Low  
Altitude, Non-Electronic Countermeasure  
(ECM) mode

Missile Mission Reliability 4/

Inherent System Availability (AI) 5/

Systems Probability of Detection  
Evaluation and Transfer (PDET) (no ECM)

Probability of Single Shot Kill (PSSK)  
(MIG-21, K-Kill)

Objectives

Demonstrated 1/

Budget Activity #4 - Tactical Programs

Program Element #2.37.31.A

Title Surface-to-Air Missile HAWK/HIP

Operational/Technical Characteristics

- a. Single Target (no ECM)
- b. Single target in a Multiple Target Formation (no ECM) 0/
- c. Single Target (ECM deception)

Inherent system effectiveness (ES)  
(Single Target, no ECM) 5/

Objectives

Demonstrated 1/

FOOTNOTES:

1/ Improved HAWK test reports through September 1976.

2/

3/ Limited by target capability.

4/ Defined as the success versus attempt ratio for a particular test of completing the launch, guide on target, and fuze operation without malfunction for a variety of mission profiles (multiple, single ECM targets) which the missile is designed to handle.

5/ Inherent availability and effectiveness do not include actual support environment.

6/ The Probability of Single Shot Kill (PSSK) results from computer simulations with the six missile modifications and is an average across the performance envelope. The simulations have been validated by live firings against multiple targets.

FY 1978 ROUTE DESCRIPTIVE SUMMARY

Program Element #2.37.32.A

Title VULCAN Air Defense Gun System

Category Operational System Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1977 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 1000    | 0       | 2000    | 193     | 4871    | 39964   | 0                        |                      |
| D182           | VULCAN Air Defense Gun System        | 1000    | 0       | 2000    | 193     | 4871    | 39964   | 2500                     |                      |
| Procurement:   | Funds                                | 20800   | 1/      | 0       | 1/      | 700     | 1/      | 88100                    | 2/                   |
|                | Quantities                           |         |         |         |         | 12500   | 2/      | 137900                   | 1/2/                 |

1/ Includes Reliability, Availability, Maintainability (RAM) Modifications  
2/ Effectiveness Improvements Modifications

BRIEF DESCRIPTION OF ELEMENT: This program provides for prototype development and testing of an effectiveness improvement package for the VULCAN Air Defense Gun System.

BASIS FOR FY 1978 ROUTE Request: Funds are requested finish the testing development of four product improvements for the VULCAN that will significantly increase the system's combat effectiveness.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The decrease in funding is due to the completion of a prototype validation effort.



Budget Activity #4 - Tactical Programs

Program Element #2.37.32.A Title VULCAN Air Defense Gun System

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |                       | <u>FY 1977</u> | <u>FY 1978</u> | <u>Total</u> |
|----------------------------|-------------|--------------------|--------------|-----------------------|----------------|----------------|--------------|
| (1) Federal Civ. Employees | 14          | 0                  | 14           | (1) Estimated Govern- | 200106         | 193            | 200299       |
| (2) Contractor Employees   | 42          | 0                  | 42           | ment Liability        |                |                |              |
| Total                      | 56          | 0                  | 56           | Financed with: RDTE   |                |                |              |

DETAILED BACKGROUND AND DESCRIPTION: The VULCAN Air Defense Gun System was fielded by the Army in 1968 to complement the CHAPARRAL Missile system in providing divisional air defense protection against modern fighter aircraft employing low altitude air attack techniques. Both of these systems were considered interim solutions and were developed using off the shelf equipment whenever possible. The VULCAN system is fielded in two versions (lowed and self propelled) and consists of a 20mm, six barrel gatling gun and a range only radar, capable of firing up to 3000 rounds per minute. It can be utilized in both the air defense or ground roles.

RELATED ACTIVITIES: ROLAND (Program Element 6.43.09.A), STINGER (Program Element 6.43.06A), CHAPARRAL (Program Element 2.37.30.A) Advance Forward Area Air Defense System Gun (Program Element 6.33.01.A), PHALANX (Program Element 6.6.05.N). Close coordination is maintained with these activities by the Army Air Defense Systems Gun Program Manager to avoid duplication of effort.

WORK PERFORMED BY: VULCAN is contracted to General Electric Corporation, Burlington, Vermont and managed by the US Army Armaments Research and Development Command, Rock Island, Illinois.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976 and Prior Accomplishments: The first VULCAN unit was activated in 1968. In December 1970, the Army initiated a Gun Air Defense Effectiveness Study (CADES) in an effort to identify the most cost effective areas for improving the VULCAN system. This study report was completed in April 1974. Procurement of modification kit components to improve the systems reliability, availability and maintainability (RAM) started in FY 1974. The installation of these improvements began in FY 1976. In 1975, the Army initiated a study to further define what effectiveness improvements would be cost effective for the VULCAN. The final report of this study, performed by the Applied Physics Laboratory (APL), John Hopkins University, was published in June 1976.

Budget Activity #4 - Tactical Programs

Program Element #2.37.32.A

Title VULCAN Air Defense Gun System

2. FY 1977 Program: Installation of the VULCAN RAM improvements will continue. Based upon the APL study the Army plans to initiate development of an effectiveness product improvement program. A prototype will be fabricated incorporating the most cost effective improvements and testing will be initiated to validate the results of the APL study.
3. FY 1978 PLANNED PROGRAM: Testing for the validation phase of the effectiveness improvement program will be completed in the first quarter. At this time, a determination will be made on whether further development is required or production warranted. No further development will be undertaken in 1978, therefore, the decrease in funding.
4. FY 1979 PLANNED PROGRAM: Based on the results of the validation phase the improvement package efforts will be terminated or further development or production initiated.
5. PROGRAM TO COMPLETION: The effectiveness improvement packages would be installed in all fielded systems. As the new Air Defense Gun enters the inventory VULCAN will be phased into the Reserve Forces to replace the currently used, but obsolete, Twin 40mm (DUSTER) air defense gun.

6. MAJOR MILESTONES

|   | <u>Date</u> | <u>Estimated DATE</u>                    |  |
|---|-------------|--|--|
|   |             | <u>Cost to Reach Events (Cumulative)</u> |  |
| a. Initiation of a Validation Phase (Prototype Fabrication) | Jan 1977    | 21878                                    |  |
| b. Completion of Validation Phase                           | Mar 1978    | 24071                                    |  |
| c. Initiate Development                                     | Oct 1978    | 24071                                    |  |

Budget Activity #4 - Tactical Programs

Program Element #2.37.32.A

Title VULCAN Air Defense Gun System

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

The contractor for the basic VULCAN system is General Electric Company, Burlington, Vermont. Engineering/Service testing (ET/ST) on the basic VULCAN, conducted by the US Army Test and Evaluation Command (TECOM), began in July 1967 concurrent with initial production and was completed in 1969. Although the system did not satisfy all the requirements of the Qualitative Materiel Requirement (QMR), fielding commenced in August 1968 and was completed in 1973. The fielded VULCANs were found to require a high level of maintenance effort. This resulted in the initiation of a reliability, availability and maintainability (RAM) improvement program in 1974 for sixteen separate improvements for VULCAN subsystems. Developmental testing by TECOM on the RAM improvements was completed in April 1976. The VULCAN system was type classified standard A1 in September 1976 and time phased installation for all fielded systems was initiated in April 1977 with an estimated completion date of December 1977. The Army will initiate an effectiveness improvement program in April 1977 to upgrade the systems effectiveness from to and its range capability from Developmental testing and evaluation plans for the four improvements (new sight, new computer, new azimuth and elevation drive motors and ammunition improvements) will be prepared subsequent to the award of a contract in April 1977. Development testing (DT) I for the modified VULCAN system is anticipated to begin in October 1978 and be completed in January 1978. Development testing (DT) II is scheduled for October 1978 through January 1980.

Developmental testing and evaluation plans for the four improvements (new sight, new computer, new azimuth and elevation drive motors and ammunition improvements) will be prepared subsequent to the award of a contract in April 1977. Development testing (DT) I for the modified VULCAN system is anticipated to begin in October 1978 and be completed in January 1978. Development testing (DT) II is scheduled for October 1978 through January 1980.

2. Operational Test and Evaluation:

Operational testing for VULCAN was completed by the US Army Test and Evaluation Command (TECOM) in 1979 at Ft. Bliss, Texas. The system was type classified standard A in May 1972. Operational tests were not conducted by a user agency or the Army's independent Operational Test and Evaluation Agency (OTEA) on the RAM improvements but the Training and Doctrine Command (TRADOC) concurred in the standard A-1 type classification action accomplished in September 1976 provided that one deficiency (inadequate manuals) and seven shortcomings uncovered by TECOM were corrected. Corrective action was initiated prior to the type classification action. Mean time between failure (MTBF) for the system was increased from 30 hours to 122 hours by installation of these modifications. Independent evaluations will be provided to the decision review prior to a production decision on the four improvements. A test program for the improved VULCAN will be developed subsequent to contract award in April 1977. Tentatively Operational Test (OT) I is scheduled to be conducted concurrently with Development Test in October 1977 - January 1978 and OT II will be conducted from October 1978 - January 1980 if required.

Budget Activity #4 - Tactical Programs

Program Element #2.37.32.A

Title VULCAN Air Defense Gun System

3. System Characteristics:

Operational/Technical Characteristics

Optically sighted (fair weather, daylight only)  
 Range only radar  
 Manual Tracking  
 20mm Gatling cannon  
 Self Propelled (mounted on M113) or towed  
 Crew of four  
 Effective Range  
 Probability of Kill ( $P_k$ )  
 Inherent Availability  
 Mean Time Between Failure (MTBF)

Objective

5000 meters

Demonstrated

5000 meters

meters  
 Not specified

300 hours

30 hours

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #2.37.33.A

Title Improved Nonnuclear LANCE Warhead Section

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/ (\$ in Thousands)

| Project Number | Title   | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT                       | 0       | 1100    | 5218    | 5921    | 0                        | 12239                |
|                | Quantities (Improved BLU-63 Munitions)          |         |         |         |         |                          |                      |
| D231           | Improved Nonnuclear LANCE Warhead Section       | 0       | 1100    | 5218    | 5921    | 0                        | 12239                |
|                | Procurement 1/                                  |         |         |         |         |                          |                      |
|                | Funds   | 0       | 0       | 0       | 0       | 14535                    | 14535                |
|                | Quantities (Improved Nonnuclear LANCE Warheads) |         |         |         |         |                          |                      |

To be Determined

BRIEF DESCRIPTION OF ELEMENT: Develop improved munition and incorporate into LANCE M251 Nonnuclear Warhead Section.

BASIS FOR FY 1978 RDT&E REQUEST: Conduct studies, analysis and tests to develop an improved BLU-63 bomblet for use in the M251 Warhead Section.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The development of the improved BLU-63 bomblet has been made a part of this effort. Previously, the bomblet improvement had been planned under US Army Armament Research and Development Command, Dover, NJ, Supporting Research Project D-691.

1/ Proposed procurement for planning, not reflected in current FY DP. Approved program will be included in next FY DP. Current Army requirement is for \_\_\_\_\_ and is under review to insure accurate reflection of Army needs.



Budget Activity #4 - Tactical Programs

Program Element #2.37.33.A

Title Improved Nonnuclear LANCE Warhead Section

PERSONNEL IMPACT:

TERMINATION COST: (\$ in Thousands)

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |                       | FY 1977<br>and<br>Prior | FY 1978 | Total |
|----------------------------|------|-------------|-------|-----------------------|-------------------------|---------|-------|
| (1) Federal Civ. Employees | 37   | 0           | 37    | (1) Estimated Govern- | 1100                    | 0       | 1100  |
| (2) Contractor Employees   | 63   | 0           | 63    | ment Liability        |                         |         |       |
|                            |      |             |       | Financed with:        |                         |         |       |
|                            |      |             |       | RDTE                  |                         |         |       |
| Total                      | 100  | 0           | 100   |                       |                         |         |       |

**DETAILED BACKGROUND AND DESCRIPTION:** The Nonnuclear LANCE (NNL) missile system is an all weather, general support artillery system to provide nonnuclear fires on high priority targets. NNL is type classified Standard and is currently being produced for foreign military sales. The US Army has been authorized and funded to procure 360 NNL missiles in FY 1977. The long term objective of this improvement program is to the effectiveness of the Nonnuclear LANCE Missile System with a unit price increase of 10% or less. This will be accomplished by development and incorporation of an improved munition. Specifically, the tasks to be completed in FY 78 are: Improved BLU-63 bomblet aerodynamic and effectiveness analysis, full-scale improved bomblet fragmentation and velocity tests, producibility studies, improved BLU-63 bomblet qualification tests and full-scale LANCE flight testing of the improved bomblet. In addition the following activities will be completed toward incorporation of the improved bomblet into the LANCE Warhead Section: studies and analysis necessary to ensure that overall system performance, accuracy, reliability and operational characteristics are not degraded by the incorporation of the improved munition, and purchase of long lead time components to support system flight tests early in FY 79.

**RELATED ACTIVITIES:** Supporting Research Project D-691 at US Army Armament Research and Development Command, Dover, NJ, has demonstrated the feasibility of improving the BLU-63 bomblet by incorporating high density fragment materials for use against light materiel and personnel. US Air Force Project PE 64602F is currently investigating and evaluating other improvements to similar munitions. All similar other service efforts are coordinated with this program.

**WORK PERFORMED BY:** Honeywell Inc., Hopkins, MN; Vought Corp., Michigan Division, Warren, MI; Chamberlain Manufacturing Corp., Waterloo, IA; AIAX Hardware Corp., City of Industry, CA; Mallory Metallurgical Co., Indianapolis, IN; Kulity Tungsten Corp., Richfield, NJ; Alcoa Aluminum, Cleveland, OH; Ordnance Research Institute, Fort Walton Beach, FL; Martin Marietta Corp., Milan, TN; Teledyne Corp., Powder Alloys Div., Clifton, NJ; Wah Chang Div., Albany, OR; US Army Missile Research and Development Command, Huntsville, AL; Project Manager for Selected Ammunition, Dover, NJ; US Army Armament Research and Development Command, Dover, NJ (Anticipated Bidders Listed).

Budget Activity #4 - Tactical Programs

Program Element #2.37.33.A

Title Improved Nonnuclear LANCE Warhead Section

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: None. This is a new start in FY 1977.
2. FY 1977 Program: This program is a new start in FY 1977 although there has been related work done which indicates this effort will be successful (See Related Activities). The effort during FY 77 will be mainly directed toward design, development test and analysis of an improved BLU-63 bomblet. Principal areas of improvement will be the incorporation of tungsten fragmenting material (in place of steel), plus the adoption of incendiary and pattern modification features developed by USAF.
3. FY 1978 Planned Program: Significant accomplishments planned for FY 1978 include selection of the improved BLU-63 bomblet final design, qualification testing of the improved BLU-63 bomblet, full-scale LANCE Warhead Section system studies and analysis aimed at incorporation of the improved bomblet into the LANCE Warhead Section. Also, it is planned to procure long lead time items (warhead sections and missile components) to support full-scale LANCE System Development testing in FY 1979. Authorization of full-scale development is essential even though prescribed conditions have not been met. This authorization is necessary to allow timely and orderly incorporation of the improved BLU-63 bomblet into the full-scale LANCE Nonnuclear Warhead as soon as improved munition is qualified at the component level (Expected to be completed by 1 Oct 1978). Increased funding over FY 77 due to inclusion of improved BLU-63 development effort previously planned under another research project.
4. FY 1979 Planned Program: The principal effort in FY 1979 will be the loading of LANCE Nonnuclear Warhead Sections with improved munitions and the conduct of full-scale Improved Nonnuclear LANCE System DT II/DT III testing. A total of nine flight tests and three non-flight ground tests will be conducted by US Army Test and Evaluation Command and these tests will be the basis for Type Classification of the Improved Nonnuclear LANCE Warhead Section. It is also planned to fly six additional Improved Nonnuclear LANCE Warhead Sections on LANCE Annual Service Practice flights to increase the confidence in and broaden the data base for the reliability of the improved unit.
5. Program to Completion: Following Type Classification action planned for approximately 1 January 1980, improved munition will be procured and incorporated into the inventory of LANCE Nonnuclear Warhead Sections. This action will be completed about

6. Major Milestones:

- a. Begin Improved Bomblet Development
- b. Improved Bomblet Final Design Selected
- c. Begin Warhead Section Loading

| Reach Events (Cumulative) | Estimated RDIE Cost to    |  |
|---------------------------|---------------------------|--|
|                           | Reach Events (Cumulative) |  |
|                           | 0                         |  |
|                           | \$4.1 mil (RDTE)          |  |
|                           | \$6.5 mil (RDTE)          |  |

| Date       |  |
|------------|--|
| 1 Oct 1976 |  |
| 1 Mar 1978 |  |
| 1 Oct 1978 |  |

Budget Activity #4 - Tactical Programs

Program Element #2.37.33.A

- d. Begin Development Testing
- e. Complete Development Testing
- f. Release for Production
- g. Complete Production of Improved Nonnuclear LANCE Warhead Sections

| Title Improved Nonnuclear LANCE Warhead Section |                     |
|---|---------------------|
| 1 Jan 1979                                      | \$9.5 mil (RDTE)    |
| 1 Oct 1979                                      | \$12.239 mil (RDTE) |
| 1 Jan 1980                                      | \$12.239 mil (RDTE) |
|   | \$29.474 mil        |
|   | (12.239 RDTE)       |
|   | (14.535 FEMA)       |
|   | ( 2.700 OMA)        |

Budget Activity #4 - Tactical Programs

Program Element #2.37.33.A

Title Improved Nonnuclear LANCE Warhead Section

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: The prime contractor for the LANCE Missile System is the Vought Corporation, Sterling Heights, Michigan. A total of 21 Foreign Military Sales (FMS) and 342 US LANCE missile flight tests have been conducted since the LANCE firing program began in 1965 through September 1976. The contractor has fired 176 Engineering Development missiles. Within the total quantity of missiles fired by the contractor, 86 missiles were devoted to the development of the currently configured and deployed system. These missiles were fired during the time period January 1970 through July 1974 - Development Test (DT) I (nuclear) - 27; DT II (nuclear) - 30; DT I (nonnuclear) - 23; DT II (nonnuclear) - 6. Included in the 30 round DT II firings is a 12 firing extension conducted to verify a redesign of the nuclear warhead adaption kit (AK) and to verify modifications to two items of Ground Support Equipment (i.e., Monitor Programmer and Guided Missile System Test Set) made to correct deficiencies found in earlier developmental testing. The DT III (Initial Production Testing) for the nuclear system was conducted in conjunction with the 12 round extension referenced above. The M238 adaption kit was type classified STANDARD in April 1973. The remaining 90 contractor firings were for early prototype testing, stockpile sampling, and product assurance for the period 1965 through September 1976. The Army firing program has included 151 firings from program start through October 1975. That quantity includes early operational testing (38), Annual Service Practice (83), safety certification (6), and Operational Test (OT) II of the current configured system (24). Environmental testing was conducted at Fort Greely, Alaska, from October 1969 to February 1970 and at Fort Sherman, Panama, from April 1970 to February 1971. The tests at Fort Greely included a live firing. Reliability, availability, and maintainability were scored during DT/OT II and are addressed in the Operational Testing Section. A problem with the warhead fuze (XM811) was a primary cause for delay in the Nonnuclear LANCE (NNL) Warhead Development Program. The combined DT/OT II program, using new production fuzes, was resumed in April 1974 and completed in July 1974. The revised program consisted of eleven live firings of the XM251 nonnuclear warhead (6 DT II and 5 OT II). The first of the 11 warhead flights was the tenth and final round of the Engineering Design Test (12 April 1974). An additional 13 new production fuzes (XM811E6) were successfully fired on regularly scheduled Annual Service Practice (ASP) missiles in order to increase confidence in the fuze. (The 13 ASP flights were not counted as part of DT/OT II). The M251 warhead was type classified STANDARD on 23 October 1974. The LANCE Nonnuclear Warhead Section DT III Program consisted of a 7 round program, six production warhead sections and one DT II configuration warhead section that had been exposed to 6 months simulated battalion storage. The flight tests began 19 Nov 75. After two successful flight tests, three tests yielded abnormally high dud rates and the DT III program was delayed in Apr 76 to investigate the causes of the high dud rate. Three nonnuclear warhead sections were flown in July 76 thru Sep 76 that aided in the dud rate investigation. Two remaining rounds were successfully flight tested in Oct 76 completing the DT III. A nine round flight test DT II/DT III test program is planned for the improved nonnuclear LANCE system to demonstrate that all technical performance requirements are satisfied. In addition to this flight test series, a three round non-flight series is planned during DT II/DT III to evaluate safety and verify hazards classification. These tests are planned for FY 1979.



Budget Activity #4 - Tactical Programs

Program Element #2.37.33.A

Title Improved Nonnuclear LANCE Warhead Section

2. Operational Test and Evaluation: The plans for combined DT/OT II of the LANCE Missile System were prepared by the US Army Test and Evaluation Command (TECOM) and the US Army Training and Doctrine Command (TRADOC) working jointly so that the combined test could provide both the developmental evaluation data required by US Army Test and Evaluation Command (TECOM) and the operational data needed by US Army Training and Doctrine Command (TRADOC). The tests were conducted at White Sands Missile Range, New Mexico during June 1971 through March 1972 using missiles and equipment from hard tool production lines by an HONEST JOHN field artillery battalion organized as a provisional LANCE battalion. A separate evaluation and a report were accomplished by TRADOC. Extensive field exercises and 19 firings were conducted by the provisional battalion. Deficiencies were found in the Guided Missile System Test Set (GMSTS) and Monitor Programmer (MP). The LANCE Missile System minus these items was type classified STANDARD on 23 May 1972. In-flight reliability, preflight reliability after loading and checkout at the firing site, and ground support reliability were all met; however, the ground mobility of the lightweight launcher was more restricted than desired when towed over rough terrain and requirements for modification of the checkout equipment were identified. The testing of corrections of Operational Test (OT) deficiencies and system accuracy are included in the Joint Army/Atomic Energy Commission (AEC, now ERDA) testing (June 1972 - January 1973). Testing verified deficiencies noted in the Guided Missile Test Set (GMSTS) and Monitor Programmer (MP), and these were corrected and the GMSTS and MP were classified STANDARD. Subsequently, the W-70 portion of the XM234 warhead section was accepted by AEC and the XM234 warhead section was type classified STANDARD in December 1973. Testing of operational suitability (OT III) was conducted in conjunction with the annual service practice and operational readiness test of the 1st Battalion, 12th Artillery. The annual service practice was conducted during December 1972 at White Sands Missile Range (WSMR). Six missiles were successfully fired. This phase of the OT III was evaluated by TRADOC. The Army's Operational Test and Evaluation Agency (OTEA) tested doctrine and tactical employment of the system during a battalion operational readiness test conducted at Fort Sill, Oklahoma, March - April 1973. Test results revealed that doctrine, organization, training, and support packages were adequate. Some minor changes in organization and the training support package were identified. Operational Test II of the Nonnuclear LANCE was conducted 8-19 April 1974 at Fort Sill, Oklahoma by OTEA and evaluated operational effectiveness, reliability, and maintainability. Phase II (firing) was conducted 25 April - 25 May by OTEA at WSMR and consisted of five live firings. Both phases were independently evaluated by OTEA, and data generated by live firings was used for reporting both DT II and OT II results. No major discrepancies were identified during this test, and no further operational testing of the nonnuclear system is currently planned. The nonnuclear warhead for LANCE was type classified STANDARD in October 1974. No operational tests are planned on the Improved Nonnuclear LANCE because the man-machine interface is not changed from that of the basic Nonnuclear LANCE. (Incorporation of improved BLU-63 bomblets into the Nonnuclear LANCE Warhead Section will not affect the man-machine interface).



Budget Activity #4 - Tactical Programs

Program Element #2.37.33.A

Title Improved Nonnuclear LANCE Warhead Section

A tabulation of LANCE DT/OT missile firings as of 30 Sep 1976 follows:

Summary of Test Firings

| <u>Test Program</u>  | <u>Launches</u> | <u>Hits</u> | <u>Misses</u> |
|--|-----------------|-------------|---------------|
| <u>Development Tests</u>   |                 |             |               |
| Nuclear System   |                 |             |               |
| Nonnuclear (Heavy Warhead) System                                |                 |             |               |
| <u>Operational Tests</u>   |                 |             |               |
| Nuclear System   |                 |             |               |
| Nonnuclear System  |                 |             |               |
| Safety Certification (Heavy Warhead<br>Section Nonnuclear XM198) |                 |             |               |

A total of 265 production configuration missiles have been flown. Of these, were successes and were failures.

NOTES:

1/ A hit is defined as a missile impacting within the reliability circle around the target. At short ranges (less than the reliability circle has a constant radius of miles about target center. (The miles is convertible to a distance which varies with the range fired). of the reliable missiles from a population having a Circular Error Probable of will impact within the reliability circle.

3. Systems Characteristics:

Operational/Technical  
Characteristics

System Accuracy (CEP):

Demonstrated  
Performance

Nuclear

Program Element #2.37.33.A

Title Improved Nonnuclear LANCE Warhead Section

Range (kilometers)

### Missile Preflight (at Launch Checkout) Reliability

Missile In-Flight (Less Warhead)  
Reliability

**Maintainability:**

Inherent Availability  
Mean-Time-to-Repair  
Organization Level  
Direct Support  
General Support

System Accuracy (CEP):

Range (kilometers)

Preflight (at Launch Checkout) Reliability  
Inflight Reliability

.78

51 minutes  
2.9 hours  
Not Tested

## Nonnuclear

Budget Activity #4 - Tactical Programs

Program Element #2.37.33.A

Title Improved Nonnuclear LANCE Warhead Section

Maintainability:

Inherent Availability  
Mean-Time-to-Repair  
Organization Level  
Direct Support  
General Support

3/

3/

1/ As of 31 Dec 76 Selected Acquisition Report (SAR).

2/ This figure represents the cumulative program value and differs from the SAR value of      which is calculated from a 25 round moving average.

3/ Same as Nuclear System characteristics.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #2.37.35.A

Title M60A1 Tank Product Improvement Program

Category Operational Systems

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                             | TOTAL FOR PROGRAM ELEMENTS Quantities | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion |      | Total Estimated Cost |
|----------------|-----------------------------------|---------------------------------------|---------|---------|---------|---------|--------------------------|------|----------------------|
|                |                                   |                                       |         |         |         |         | 4066                     | 4813 |                      |
| DE01           | M60A1 Product Improvement Program |                                       | 3053    | 865     | 4556    | 4813    | 4918                     |      | 50338                |
| Procurement:   |                                   |                                       |         |         |         |         |                          |      |                      |
|                | Funds 1/ Quantities               |                                       | 48400   | 11500   | 93900   | 125600  | 384400                   |      | 768000               |

1/ Funding includes procurement of varying yearly quantities of various improvement kits: Improved Air Cleaners, Improved - Reliability Engine, Improved Electrical System, Laser Rangefinder, Solid State Ballistic Computer, Passive Night Sights, and Driver's Passive Night Viewer plus Tank Thermal Sight in 1977.

BRIEF DESCRIPTION OF ELEMENT: Provides for continuing (Phase I in procurement, Phase II now in RDTE) series of improvements in firepower, mobility, RAM (reliability, availability and maintainability) and night capability of the M60A1 tank.

BASIS FOR FY 1978 RDTE REQUEST: Funds Development Test/Operational Test II (WT II/OT II) of muzzle reference system, improved final drive, and ammo relocation/improved commander's station. Descriptions of Phase I and II items are on Page 2, Detailed Background and Description.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Army realignment of priorities in FY 1977 allowed work on only four of eight planned product improvement items. Transition from engineering development to testing requires slightly higher funding level in FY 1978.

Budget Activity #4 - Tactical Programs

Program Element #2.37.35.A Title M60A1 Tank Product Improvement Program

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                           | RDTE | PROCUREMENT | TOTAL |
|---------------------------|------|-------------|-------|
| (1) Federal Civ Employees | 24   | 0           | 24    |
| (2) Contractor Employees  | 86   | 510         | 596   |
| Total                     | 110  | 510         | 620   |

DETAILED BACKGROUND AND DESCRIPTION: Phase I of the M60A1 Tank Product Improvement Program (PIP) included the development/engineering and application of nine major product improvements: a main gun stabilization system, a solid-state ballistic computer, a laser rangefinder, a tube-over-bar suspension system, an improved reliability engine, T142 track, an improved electrical system, top-loading air cleaners, and passive night vision. The application of these nine improvements provides M60-series tanks increased capabilities in the areas of reliability, mobility, firepower, and night operations. The development/engineering effort associated with the program is funded from RDTE and procurement resources. With exception of the tube-over-bar suspension system, which has been deferred for further tests, Phase I of the PIP was completed in FY 1975. Phase II, or follow-on product improvement of the M60A1 tank, was initiated in FY 1975 and includes eight further improvements. These include a muzzle reference system, relocating the turret ammunition storage and an improved commander's station, an engine smoke generator, a low-profile commander's cupola, an improved final drive, a loader's weapon mount, side skirts, and wiring for mounting secure radio equipment and laser/radiation/gas alarm systems. In addition, two XM-1 developed suspension systems will be evaluated against the Phase I developed tube-over-bar suspension to determine which should be procured.

RELATED ACTIVITIES: In FY 1972 this program was carried as Project DE01 under Program Element (P.F.) 6.46.04.A, Mobility. The thermal sight prototype effort reported in FY 73 under P. F. 6.46.04.A is now under P. F. 6.46.15.A, Tank Thermal Sight. Advanced development of the Turret Integrated Xenon Illuminator (TIXI) was accomplished under P. F. 6.37.17.A, Surveillance, Target Acquisition and Night Observation, Project NK70, Night Vision Devices. The TIXI project was terminated in FY 1976.

WORK PERFORMED BY: In-house efforts on this P. F. E. are accomplished by the Project Manager for M60 Tanks (Development), Warren, MI, the U. S. Army Electronics Research and Development Command, Night Vision Laboratory, Fort Belvoir, VA. Major contractors are Chrysler Defense Engineering, Centerline, MI; Hughes Aircraft Company, Culver City, CA, and Teledyne-Continental, Muskegon, MI.

TERMINATION COST: (\$ in Thousands)

|  | FY 1977 &<br>Prior | FY 1978 | Total |
|--|--------------------|---------|-------|
| (1) Estimated Government Liability<br>Financed with: | 24572              | 0       | 24572 |



Budget Activity #4 - Tactical Programs

Program Element #2.37.35.A      Title M60A1 Tank Product Improvement Program

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Development of the solid-state computer, laser rangefinder and tube-over-bar suspension was initiated in FY 1971. Three solid-state computers and one laser rangefinder were delivered for engineering design, qualification, and reliability tests. Development prototypes (laser rangefinder, solid-state computer, and tube-over-bar suspension) were integrated along with the other product improved components into three test tanks for contractor testing. Contractor testing commenced in December 1972 but was terminated 14 March 1973 due to reliability problems and an inability to zero the main gun. A program extension of six months resulted from a redesign effort to correct deficiencies in the fire control components. Development effort on the solid-state computer, laser rangefinder, and tube-over-bar suspension; engineering of the Reliability Improved Selected Equipment (RISE) engine and improved electrical system; and design system engineering continued in FY 1974. Contractor testing resumed in September 1973. Development Test II (DT II) was completed in May 1975 and Operational Test II (OT II) testing was completed in January 1975. A Cost and Operational Effectiveness Analysis was performed by Concepts Analysis Agency and various analyses made by independent agencies in support of the Development Acceptance In-Process Review (DEVA-IPR). All parties to the November 1975 DEVA-IPR concurred in the project manager's recommended program which was: to apply the three passive devices (M35E1 Gunner's Sight, M36E1 Commander's Sight, and AN/VVS-2 Driver's Viewer) the AN/VVG-2 laser rangefinder, and the M60A1 solid state computer to the M60A1 (RISE) baseline tanks, designate it the M60A1E3, and initiate low rate initial procurement. This essentially ended RDTE efforts on Phase I product improvements. Two more prototypes of the hydronematic suspension system were delivered for side-by-side testing against the conventional system, high strength torsion bars, and hybrid tube-over-bar suspension. This testing will be completed in early 1977.

2. FY 1977 Program: Full scale hardware of the relocation of turret ammunition stowage and improved commander's station will be fabricated and a technical data package prepared. Similar actions will be accomplished on the improved final drive and muzzle reference system, and a start made on the loader's weapon mount and alarm/commo adaption hardware. Adaption of the M60A1 add-on stabilization system to M60 and M48A5 tanks will be developed and tested. An IPR to determine the best type of improved suspension system based upon completed side-by-side tests will be held in May 1977.

3. FY 1978 Planned Program: DT/OT II is planned for the muzzle reference system, improved final drive, and ammo restowage/improved commander station.

4. FY 1979 Planned Program: Producibility, Engineering and Planning (PEP) for improved final drive muzzle reference system, and ammo restowage/improved commander's station, and transition into production. Engineering design on the remainder of the improvements will be accomplished and fabrication of full scale hardware will commence.

5. Program to Completion: Completion of Phase II improvements and final transition into procurement.

Budget Activity #4 - Tactical Programs

Program Element #2.37.35.A

Title M60A1 Tank Product Improvement Program

6. Major Milestones Required:

|   | <u>Date</u> | <u>Estimated RDTF Cost to Reach<br/>Events (Cumulative Phase II)</u> |
|---|-------------|--|
| a. Contractor and Quality/Reliability Tests | FY 1978     | 8798   |
| b. Development Test/Operational Test II     | Jan 1979    | 13611  |
| c. Development Acceptance In-Process Review | Nov 1979    | 18529  |

Budget Activity #4 - Tactical Programs

Program Element #2.37.35.A

Title Tank, Combat, FT, 105MM Gun, M60A1/A3

TEST AND EVALUATION DATA:

1. Development and Test Evaluation:

a. The Chrysler Corporation was awarded a production contract for the M60A1 Tank and deliveries were initiated in October 1962. The M60A1 Tank is an improved version of the M60 Tank. The original M60A1 Tank Program started with the fabrication of three Research and Development (R&D) pilots. Testing similar to PT II was accomplished at Aberdeen Proving Ground, MD; Yuma Proving Ground, AZ; and Fort Knox, KY, from May to December 1961. Test results indicated that the M60A1 was suitable for adoption and production. The M60A1 was type classified Standard-A 14 December 1961.

b. Modifications to the M60A1 are being added to improve the combat effectiveness, efficiency and reliability of the tank. These product improvements are the Top Loading Air Cleaner; T-142 Steel Track; Improved Electrical System; Improved Reliability (RISE) engine; and Gun Stabilization System. All five of these improvements were included in the FY 75 M60A1 Tank Program. In addition to these improvements, the Laser Rangefinder, Solid State Ballistic Computer, Tank Commander's and Gunner's Passive Night Sight, and the Driver's Passive Night viewer will be included on a limited quantity of M60A1 Tanks in the FY 1976/1977 and FY 1977 programs. With application of these additional improvements, the M60A1 is planned for redesignation as the M60A3 1/ Tank.

c. Prior to acceptance, extensive qualification testing and development testing (Engineering Test/Service Test) were conducted on the first three improvements during the mid-to-late 1960's.

(1) A design project was initiated in 1967-68 for the top loading air cleaner (TLAC). Reliability analysis and qualification testing on the air cleaner were completed in July 1971. Contractor testing was conducted at Fort Knox, Fort Hood, and Yuma PG from February 1969 to October 1972. All early testing proved the air cleaner satisfactory and it was released to tank production in FY 1971 Program.

(2) The add-on stabilization (AOS) was designed in 1965. During the period 1966-1971, the AOS successfully completed reliability tests, qualification tests, contractor tests (including Arctic testing), Development Test II, check testing, and troop testing. A total of 30,000 test miles was completed. Based on the success of these tests, the AOS was incorporated in FY 1972 production tanks and retrofit kits were placed on contract with FY 1974 funds. Initial production tests (PT III) of the FY 1972 tank with AOS were conducted during the period April 1973 to December 1973. Test results were satisfactory to continue production of the M60A1 with AOS.

1/ Until Classified STANDARD, the M60A3 is designated the M60A1E3.

Budget Activity #4 - Tactical Programs

Program Element #2.37.35.A Title Tank, Combat, FT, 105MM Gun, M60A1/A3

(3) The T-142 Tank was designed in 1965. The T-142 Tank has been tested through over 100,000 miles under all kinds of climate and terrain environments. Based on these results the T-142 was approved for production and underwent development test (DT III) (Initial Production Testing) successfully during the period April 1972 to October 1972. The tank was included on new production tanks beginning with the FY 1974 tank procurement. The tank has also been procured with OMA funds (beginning FY 1973) as replenishment tank for field replacement.

(4) The improved-reliability (Reliability Improved Selected Equipment; RISE) engine and improved electrical system (oil-cooled alternator and solid state regulator) were subjected to extensive reliability and qualification testing in the early 1970's during DT I of the M60A3, conducted during the period December 1972 to June 1974; the RISE engine and the improved electrical system met all established requirements and had demonstrated such favorable results that the Army proceeded to include them on the FY 1975 M60A1 procurement tank. Additional DT II testing was conducted at Yuma Proving Ground during FY 1974 to insure hot climate reliability of the engine and electrical system.

d. The total M60A3 system, incorporating the five improvements noted above and the laser rangefinder and solid state ballistic computer, is being subjected to a complete series of development tests. Initial components were subjected to laboratory reliability, qualification, life, and environmental test requirements of MIL-STD-810B. Three tanks were used for early development: one for engineering design tests, one for math model and system analysis and one for logistical support, maintenance evaluation, and publications. Three additional tanks were assembled for contractor engineering tests which completed about 4000 miles of operation and fired 800 rounds of main gun ammunition for each tank. Fight tanks were used in DT II January to October 1974; two at Aberdeen Proving Grounds, one to Yuma Proving Grounds initially and later shipped to Aberdeen Proving Grounds for Electromagnetic interface testing and the remaining five to Fort Knox, KY. DT II testing was successfully completed in May 1975 with a total of 13,000 miles and 4,000 rounds of testing accumulated.

e. DT III will take place in 2 phases: the Production Validation Test-Contractor (PVT-C) at Chelsea, MI, and Aberdeen Proving Ground, MD, (APG) from April 1978 to September 1978 and the PVT-Government at APG from August 1978 to January 1979. Five new production and 4 retrofitted M60A3 tanks are scheduled for these tests accumulating some 28,000 miles of operation.

The following are projected milestones in development and production of the M60A3 Tank.

- |  |               |
|--|---------------|
| (1) First Production (Low Rate Initial Production) | Feb 78        |
| (2) Initial Production Tests (DT III)              | Apr 78-Jan 79 |
| (3) Production Validation IPR                      | Mar 79        |

Budget Activity #4 - Tactical Programs

Program Element #2.37.35.A

Title Tank, Combat, FT, 105mm Gun, M60A1/A3

2. Operational Test and Evaluation:

a. The M60A1 Tank has been in the Army inventory since 1962. It was approved for service use in December 1961 (Type Classified Standard-A). It is the Main Battle Tank for all Active Army Armored, Mechanized, and Infantry Divisions and all Armored Cavalry Regiments. The tank has met with widespread user acceptance.

b. Normal qualifications and check tests were performed on the top loading air cleaner and T-142 Track. Both items were on the M60A2 tanks during service testing at Fort Knox and were separately monitored and evaluated.

c. The gun stabilization system successfully completed its Engineering Test/Service Test (ET/ST) during the period 14 June-15 September 1971 at Fort Hood, Texas, and White Sands, New Mexico. Combat Developments Command (CDC) prepared an independent evaluation and report on the test. A production decision was made in November 1971.

d. The improved reliability engine and improved electrical system are reliability improvements accomplished by modifications to basic components. Both improvements have undergone testing since June 1973 at Fort Knox, Yuma Proving Ground and Detroit. Established reliability goals were exceeded.

e. The five improvements (paragraph 1b above) along with the Laser Rangefinder and Solid State Ballistic Computer, were evaluated during Operational Test (OT) II to determine the operational capability of the product improved system. OT II was conducted separate from Development Test II by the Operational Test and Evaluation Agency (OTEA) from 21 October 1974 to 24 January 1975 at Fort Knox, Kentucky using ten TRADOC tank crews. Ranging and firing exercises were also conducted from 20 to 24 March 1974 and from 26 March to 4 April 1975 at Fort Knox, KY. Overall results of OT II indicated the improvements provided the M60A1E3 with superior hitting performance, reduced range error, and improved operational performance at night. The test also identified requirements for more comprehensive crew and maintenance personnel training. OTEA provided an independent evaluation and report to the Development Acceptance In-Process Review (DEVA-IPR) for consideration in a production decision on the M60A3 tank. The decision of the November 1975 DEVA-IPR was to initiate low-rate initial production and conduct testing towards type classification standard and full production.

f. The separate OT III scheduled for September 1978-January 1979 at Fort Hood, Texas, was waived by HQDA on 20 October 1976 on the recommendation of OTEA since all major operational issues had been addressed in OT II. TRADOC will conduct an Initial Operating Capability Force Development Test and Evaluation (IOC FDEVT) to fully refine doctrinal and training packages. The test will take place between February and June 1978 and will utilize 18 tanks in a Forces Command unit at Ft. Hood, TX, to assess training and logistical implications of the M60A3 and concurrently perform an OT III on the Tank Thermal Sight. OTEA will monitor the OT III testing and provide an independent evaluation, particularly assessing RAM data.



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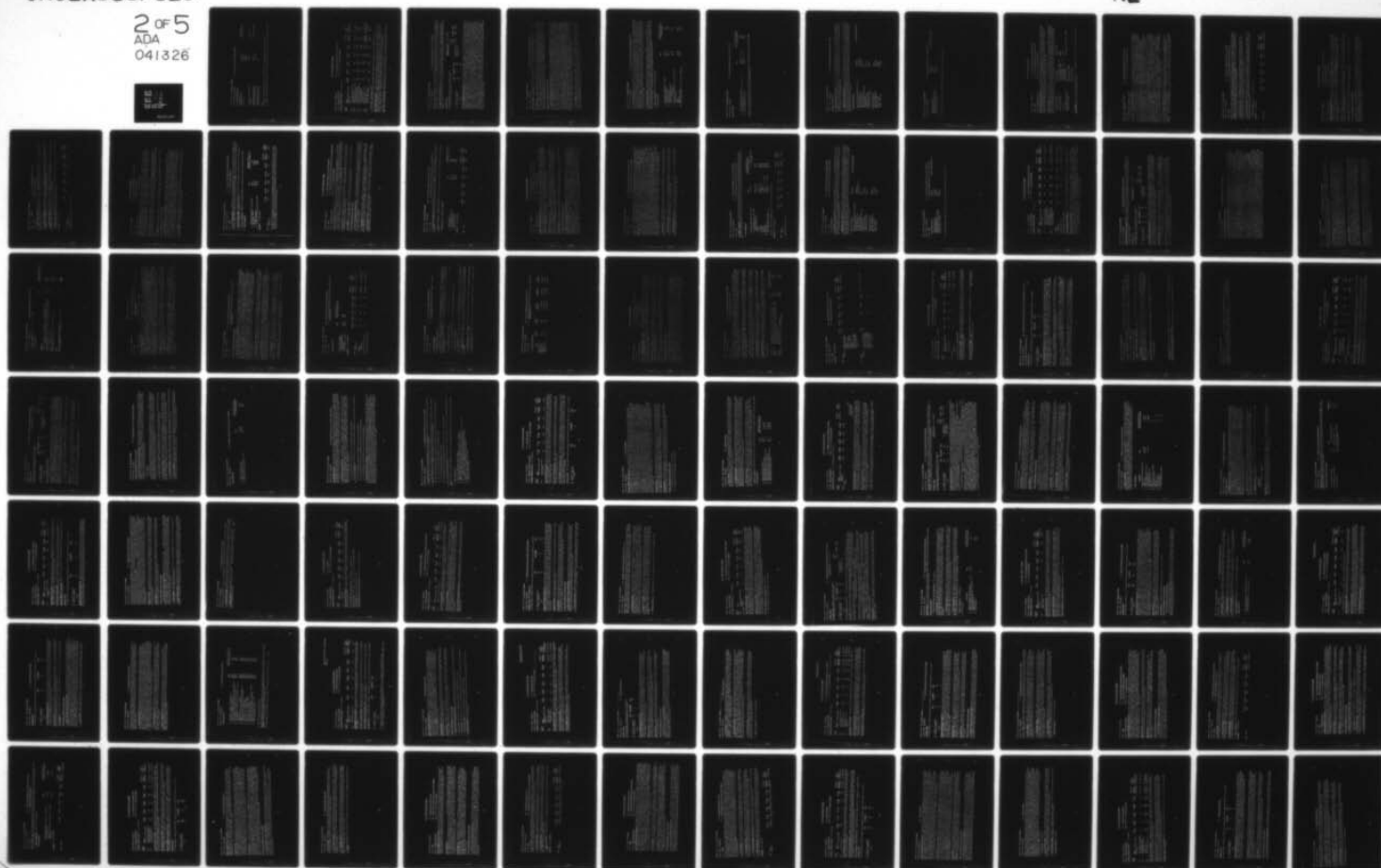
DEPUTY CHIEF OF STAFF FOR RESEARCH DEVELOPMENT AND AC--ETC F/G 5/1  
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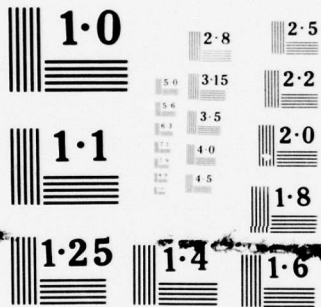
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NATIONAL BUREAU OF STANDARDS  
MICROCOPY RESOLUTION TEST CHART

Budget Activity #4 - Tactical Programs

Program Element #2.37.35.A

Title Tank, Combat, FT, 105MM Gun, M60A1/A3

3. System Characteristics:

Operational/Technical Characteristics

Service Life

Demonstrated Performance (DT II)

1/

Objective

5000 miles between overhaul

Reliability (Mean Miles Between Failures)

140 miles

128/150/191 2/

Maintainability (Mean Time to Repair) (Organization level)

6 hours 95% of time

6 hours 96.4% of time

Maintenance Ratio (Maintenance Man-hours/Operational Hours)

1.3/1

1.3/1

Notes:

1/ Values to be determined from Baseline Armor Reliability Test (BART), final result due late Feb 1977.

2/ Source: DT II (Service Phase). Values are: early data/adjusted early data based on fixes/data subsequent to fixes.

# FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #2.80.10.A Title Joint Tactical Communications Program (TRI-TAC)

Category Operational Systems Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|--|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities*          | 5909    | 9957    | 58876   | 48980   |                                     |                                     |
| D104           | Joint Tactical Communications (TRI-TAC) Office | 4640    | 1224    | 5499    | 5768    | Continuing                          | Not Applicable                      |
| D110**         | Mobile Subscriber Access (MSA)                 |         |         |         |         |                                     |                                     |
| D111           | Communications System                          | 100     | 100     | 1254    | 4968    | 95202                               | 103200                              |
| D113           | Digital Group Multiplexers                     | 8170    | 2100    | 4214    | 713     | 290                                 | 27680                               |
|                | Super High Frequency Satellite                 |         |         |         |         |                                     |                                     |
| D114           | Modulator-Demodulator                          | 100     | 125     | 2321    | 6580    | 5383                                | 15409                               |
|                | Other Service TRI-TAC                          |         |         |         |         |                                     |                                     |
|                | Assigned Tasks                                 | 804     | 200     | 2137    | 2230    | Continuing                          | Not Applicable                      |
| D172           | Net Radio Interface (NRI)                      | 0       | 0       | 1253    | 2111    | Continuing                          | Not Applicable                      |
| D178           | Joint Test Office                              | 0       | 0       | 1065    | 1137    | Continuing                          | Not Applicable                      |
| D222           | Automatic Communications                       |         |         |         |         |                                     |                                     |
|                | Control Office AN/TTC-39                       | 46095   | 6208    | 41133   | 25473   | 10800                               | 181700                              |

\* Large Number of diversified items.

\*\* D110 includes NRI and Mobile Subscriber Equipment (MSE) through FY 1977; thereafter, D110 is MSE and D172 is NRI.

BRIEF DESCRIPTION OF ELEMENT: TRI-TAC is a joint tactical communications program established to achieve interoperability between Army tactical communications systems and other Department of Defense (DOD) telecommunications systems; to provide new tactical communications equipment which reflects the most recent technology; and to eliminate duplication among the Service/Agency communications systems. The Director of TRI-TAC, under the Secretary of Defense, with primary staff supervision by the Office of Secretary of Defense, Director, Telecommunications and Command and Control Systems, acts as the system architect.

BASIS FOR FY 1978 RDTE REQUEST: Consists of the effort to support the TRI-TAC Office mission; letting a Full Scale Development (FSD) contract for the Net Radio Interface (NRI) and Validation contract for the Mobile Subscriber Equipment (MSE) of the Mobile

Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

Subscriber Access (MSA) project; monitoring and supporting the Full Scale Development (FSD) for the Digital Group Multiplexer (DGM) project; award of a 24-month contract to industry for validation models of the Super High Frequency (SHF) Satellite Modulator/Demodulator (Modem); management of Army interests in other Service TRI-TAC projects; and continuation of the AN/TTC-39 Development.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The increase of FY 1978 over FY 1977 is primarily to support an increased funding requirement for the TRI-TAC Switch, AN/TTC-39. In addition, Concept Evaluation begins for the Mobile Subscriber Equipment (MSE), Net Radio Interface (NRI), and SHF Satellite Modem. Also in FY 1978, the Army funds separately its portion (35%) of the Joint Test Element.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 206  | 0           | 206   |
| (2) Contractor Employees   | 361  | 0           | 361   |
| Total                      | 567  | 0           | 567   |

TERMINATION COST: (\$ in Thousands)  
(AN/TTC-39 & DGM)

|   | FY 1977<br>and<br>Prior | FY 1978 | Total  |
|---|-------------------------|---------|--------|
| (1) Estimated Govern-<br>ment Liability | 117200                  | 36600   | 153800 |
| Financed with:                          |                         |         |        |

DETAILED BACKGROUND AND DESCRIPTION: TRI-TAC has been established as a joint Army, Navy, Marine Corps, and Air Force program to: (1) assure compatibility and a high degree of commonality of tactical communications systems and devices used in joint combat force operations; and (2) achieve maximum economy through joint Service development, acquisition, and follow-on support of tactical communications equipment. TRI-TAC will provide a single, multichannel tactical communications system for trunking and switching to support US combat forces in the early 1980's. It will interconnect with the Defense Communications Systems (DCS) and have the capability to interface with systems of our allies (i.e., North Atlantic Treaty Organization). The proposed TRI-TAC program will provide a joint Service tactical switched trunking capability for voice and record communications and for data communications to support the employment of evolving computerized weapon systems. Advances in solid-state electronic circuit technology and the increasing availability of low cost, wide band transmission media will be exploited to obtain: (1) a faster rate of information transfer; (2) transmission security; (3) better mobility through size and weight reductions; and (4) improved reliability and maintainability. The scope of this program is as follows: (1) costs of operating the TRI-TAC Office, Fort Monmouth, New Jersey, including support contracts; (2) cost of accomplishing acquisition tasks for the TRI-TAC program assigned to the Army by the Office of the Secretary of Defense; and (3) cost associated with tasks assigned to other Services for development. There are fifteen items of TRI-TAC equipment which have been assigned to the Services. Four items have been assigned to the Army - The Automatic Switch (AN/TTC-39), Digital Group Multiplexer (DGM), Super High Frequency (SHF) Satellite Modulator/Demodulator (Modem); and Mobile Subscriber Access Communications System.



Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

RELATED ACTIVITIES: The Air Force, Navy, Marine Corps, National Security Agency, and Defense Communications Agency, are participating in TRI-TAC. Related programs include all other Service and Agency efforts under program elements 2.80.10.( ).

WORK PERFORMED BY: Overall system architecture and interservice coordination is performed by the TRI-TAC Office, Fort Monmouth, New Jersey. The Director, TRI-TAC Office, reports to the Director, Telecommunications and Command Control Systems, Office of the Secretary of Defense. Acquisition (development and production) of equipment is performed by the Services and Agencies as assigned by the Secretary of Defense. Current contractors are: GTE Sylvania, Needham Heights, Massachusetts; Booz-Allen Applied Research, Inc., New Shrewsbury, New Jersey; RCA, Camden, New Jersey; Raytheon Company, Sudbury, Massachusetts; and IRW, Redondo Beach, California. In-house developing organization, for tasks assigned to the Department of the Army, is US Army Communications Research and Development Command, Fort Monmouth, New Jersey (Project Manager, Multi-Service Communications Systems (MSCS)).

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Accomplishments consisted of developing specification and awarding two competitive contracts for the AN/TTC-39 switch. Development of a specification for technical control equipment for the AN/TTC-39 switch was begun. The AN/TTC-39 switch contractors submitted their prototype model design plans to the Government. Development and testing of prototype models of the AN/TTC-39 switch and associated technical control equipment were completed, and an engineering development contract was awarded to GTE Sylvania in April 1974. By this time all necessary experimental work had been performed under the prototype phase, and the switch and associated technical control equipment were ready for full scale development. Program guidance for the AN/TTC-39 switch was approved by the Defense Systems Acquisition Review Council (DSARC) on 12 April 1974. Competitive specifications were developed for the Digital Group Multiplexers and a Full Scale Development contract was awarded in May to Raytheon Company. A study contract was awarded to Communications Satellite Corporation to consider Service requirements for the Super High Frequency (SHF) Satellite Modulator/Demodulator (Modem). Work began on the Net Radio Interface (NRI) specifications for a Full Scale Development (FSD) contract to be let in FY 1978, and Army Mobile Subscriber Equipment (MSE) requirements were assessed. Execution of the design phase, including Preliminary and Final Design Reviews, was accomplished for the Digital Group Multiplexers. The study contract was completed on the SHF Satellite Modem and the results of draft specifications are being evaluated. Special DSARC Review recommended for AN/TTC-39 program because of anticipated breach of DCP 135 Cost and Schedule Thresholds for Full Scale Development. Work continued on efforts required to let a FSD contract on the NRI. Other Service Tri-TAC efforts were monitored. AN/TTC-39 contractor directed to implement replanning actions constraining development effort through FY 1977 within a cumulative funding cap of \$96.0 million. Army provided funds for the TRI-TAC Office.

2. FY 1977 Program: The NRI effort will consist of completion and issuance of a Request for Proposal (RFP) for the FSD contract, and the MSE effort will be the completion of specifications, statement of work, and issuance of an RFP. Prototype Qualification Testing of the Digital Group Multiplexer (DCM) will begin and models will be delivered to Air Force for the Tactical Communications Control Facility program. A 24-month contract to industry will be let for validation models of the SHF Satellite Modem. Include start of Preliminary Qualification Test (POT) for AN/TTC-39 Circuit Switch.

#### Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A

#### Title Joint Tactical Communications Program (TRI-TAC)

3. FY 1978 Planned Program: The Net Radio Interface (NRI) Full Scale Development (FSD) contract will be awarded and planning will begin for Development Test/Operational Test (DT/OT). A Validation contract will be let for the Mobile Subscriber Equipment (MSE). Equipment will be delivered and DT/OT II testing will begin for the Digital Group Multiplexers. Engineering will continue for six Super High Frequency (SHF) Satellite Modulator/Demodulator (Modem) validation models. Start of Development Test and Evaluation/Initial Operational Test and Evaluation (DTE/IOTE) for AN/TTC-39 Message Switch and start of Preliminary Qualification Test (PQT) for AN/TTC-39 Circuit Switch. The increase of FY 1978 over FY 1977 is primarily to support an increased funding requirement for the AN/TTC-39 switch program. In addition, validation phase contract awards for the Mobile Subscriber Equipment (MSE), Net Radio Interface (NRI), and SHF Satellite Modem are scheduled. Additionally, the Army begins separately funding the assigned portion (35%) of the Joint Test Element.

4. FY 1979 Planned Program: Continuation of AN/TTC-39 Message Switch and start of AN/TTC-39 Circuit Switch DTE/IOTE. End of Validation Phase on MSE and FSD of NRI; Digital Group Multiplexers (DGM) testing and support by contractor to test program; SHF Satellite engineering and fabrication will be complete; contractor PQT and delivery of DT/OT will occur. The decrease in FY 1979 from FY 1978 funding is primarily due to the completion of Engineering Development models of the AN/TTC-39 (fabrication and Prototype Qualification Testing). The remaining AN/TTC-39 effort is primarily the conduct of DTE/IOTE.

5. Program to Completion: This is a continuing program.

#### 6. Major Milestones:\*

|  | Date   | Estimated RDTE Cost to Reach Events (Cumulative)<br>(\$ in Millions) |
|--|--------|--|
| a. Engineering Development Contract Award  | Apr 74 | 24.0   |
| b. Preliminary Design Review   | Sep 74 | 30.0   |
| c. Integrated Test Plan  | Feb 75 | 47.0   |
| d. Final Design Review   | Dec 75 | 61.9   |
| e. Preliminary Qualification Test Complete                                       | Apr 78 | 153.4  |
| Message Switch Circuit Switch  | Nov 78 | 172.4  |
| f. Development Test and Evaluation/Initial Operational Test and Evaluation Start | Jul 78 | 160.0  |
| Complete   | Nov 79 | 184.4  |
| g. Long Lead Item Award  | Nov 79 | 202.0  |
| h. Defense Systems Acquisition Review Council (DSARC) III                        | 3Q 76  | 202.0  |

Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A

Major Milestones\*

Title Joint Tactical Communications Program (TRI-IAC)

|   | <u>Date</u>         | <u>Estimated RTE Cost to<br/>Reach Events (Cumulative)<br/>(\$ in Millions)</u> |
|---|---------------------|---|
| i. Low Rate Initial Production Award                        | DSARC III + 1 mo.   | 202.0   |
| j. Defense Systems Acquisition Review Council (DSARC) III A | 4Q 82               | 202.0   |
| k. Full Scale Production                                    | DSARC III A + 1 mo. | 202.0   |
| l. Initial Operational Capability                           | 2Q 82               | 202.0   |

\* Milestones shown for Project Number D222, Automatic Communications Control Office AN/TTC-39, which is only current major system in the program element and is the lead TRI-IAC development item.

Budget Activity #4 - Technology Base

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: The contractor for the AN/TTC-39 is GTE Sylvania. A combined Development Test and Evaluation and Initial Operational Test and Evaluation (DTE/IOTE) is scheduled to commence in July 1978. The test will continue through November 1979. Primary test site is Fort Huachuca, Arizona. The final development Test and Evaluation/Initial Operational Test and Evaluation Joint Test Plan was forwarded on 27 February 1975, for Office of Secretary of Defense (OSD) review and coordination. The test design was considered adequate by OSD.

2. Operational Test and Evaluation: No operational tests have been conducted on the AN/TTC-39. A joint DTE/IOTE is scheduled for July 1978 - November 1979 at Fort Huachuca, Arizona, and Davis Monthan AFB, Arizona. It is expected that the Engineering Development equipment to be tested will be essentially the same as the production models although the switch modularity may vary according to specific employment of production equipment. Contractor support will continue during the testing. Reliability and Maintainability is an important part of the test program and will be evaluated during the test in accordance with the criteria currently being approved as part of the test plan.

3. System Characteristics:

Circuit Switch (750 Terminations)/(300 Line)

Inherent Availability  
Mean Time Between Failure  
Mean Time to Repair  
Simultaneous Conference  
Maximum Conferences per Conference  
Alternate Routing  
Standby Battery Power  
Terminations per Module  
Maximum Weight per Shelter

Objective

.9999/.999  
2500/250 hours  
15 minutes  
6/4  
20  
Up to 5  
15 minutes  
150  
7000 lbs.

Demonstrated Performance 1/

Message Switch (50 Line)  
Inherent Availability  
Mean Time Between Failure  
Mean Time to Repair  
Reference Storage  
Journal Storage  
Standby Battery Power

.9999  
2500 hours  
15 minutes  
10 days  
30 days  
15 minutes

Budget Activity #4 - Technology Base

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-IAC)

Demonstrated Performance 1/

Objective

Message Processing Time  
Throughput Characters per Second  
Bit Error Rate per Consecutive Bits  
Maximum Weight per Shelter

2 seconds  
9000  
1 per 10<sup>10</sup>  
7000 lbs.

1/ Testing is scheduled to begin in July 1978. No performance characteristics have been tested to date.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #2.80.10.A

Title Joint Tactical Communications (TRI-TAC) Program

Project #D104

Title Joint Tactical Communications (TRI-TAC) Office

Category Operational Systems

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of the TRI-TAC Program is to achieve the necessary degree of interoperability among tactical communications and other Department of Defense (DOD) telecommunications systems; to place in the field in a timely manner new tactical communications equipment required by the Armed Forces to perform their missions and which reflect the most effective technology; and to eliminate duplication, where feasible, in the development of Service equipment. This project provides funds for operation of the TRI-TAC Office as prescribed by DOD Directive 5148.7.

RELATED ACTIVITIES: This project is part of the Joint Tactical Communications (TRI-TAC) Program. Tasking for the development and initial procurement of other equipment has been assigned to the services and National Security Agency (NSA). The Army related projects in PE 28010A are: D110 - Mobile Subscriber Equipment; D111 - Digital Group Multiplexer; D113 - Super High Frequency (SHF) Satellite Modulator-Demodulator (Modem); D114 - Other Services TRI-TAC Tasks; D222 - Automatic Communications Central Office, AN/TTC-39; D172 - Net Radio Interface; and D178 - Joint Test Support. The other services/NSA related efforts are as follows:

Air Force (PE 28010F)

NSA (PE 33401G)

Navy (PE 28010N)

Technical Control Facilities

Tactical Digital Facsimile (TDF)

TENLEY

Digital Tropo Terminal

Ultra High Frequency (UHF)

SEELEY

Data Adapter

Satellite Modem

SELDON

Digital Non-Secure Voice Terminal

Advanced Narrowband Digital Voice Terminal (ANDVT)

ANDVT-Communications Security (COMSEC)

Short Range Wide Band Radio

Joint Service Testing

Joint Service Testing

Marine Corps (PE 28010M)

Unit Level Switches

Joint Service Testing

WORK PERFORMED BY: TRI-TAC Office, Fort Monmouth, New Jersey. Supporting Contractor effort is furnished by Booz Allen Public Administration Service, Inc., New Shrewsbury, New Jersey.

Budget Activity #4 - Tactical Programs  
Program Element #2.80.10.A  
Project #D104

Title Joint Tactical Communications (TRI-TAC) Program  
Title Joint Tactical Communications (TRI-TAC) Office

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The Joint Tactical Communications (TRI-TAC) Office was officially established by the Secretary of Defense and became effective on 1 July 1971. The development of a Joint Service Specification for the TRI-TAC Switch (AN/TTC-39) including that required for the related Communications Security (COMSEC) equipment was completed, and validation contracts were awarded by Project Manager, Army Tactical Communications Systems and National Security Agency (NSA). A joint test facility was established for testing of the AN/TTC-39 and related COMSEC. The Joint Tactical Communications Master Plan, Land Based Switched System Plan, Naval Switched Subsystem, Transitional Plan, Subsystem Plans, and Test plans were prepared and distributed to all program participants by the TRI-TAC Office. In April 1974 engineering development of the AN/TTC-39 was approved. Contracts for full scale development of the AN/TTC-39 and the related COMSEC were awarded by the Army and NSA respectively. The Air Force awarded a contract for development of the Technical Control Facility and the Army awarded an engineering development contract for a family of Digital Group Multiplexers (DGM). The TRI-TAC Office revised plans including Aspect Papers, Architecture documents and continued efforts in areas of Interoperability and Interface Control, Logistics and Data Management and Test Planning activities. Activities related to program review and configuration control as well as Program Budget Reviews including issuance of a Program/Budget Guide were also accomplished. The Air Force awarded contracts for the full scale development (FSD) of the Tropo Terminals and the Digital Non-secure Voice Terminal. The Navy awarded a contract for the FSD phase of the Ultra High Frequency (UHF)-Demand Assigned Time Division Multiple Access (TDMA) Modems. DOD Directive 5148.7 was reissued by the Deputy Secretary of Defense (DepSecDef) in February 1976 assigning Director, TRI-TAC responsibilities for coordinating the conduct, planning and reporting of Joint Testing of TRI-TAC systems and equipment. By Memorandum dated 12 March 1976, the DepSecDef established the Joint Test Facility and Organization for the TRI-TAC Program. DOD Instruction 5148.8 of April 1976 provided implementing instructions and amplified responsibilities of the TRI-TAC Office in Joint Test and Evaluation of TRI-TAC Equipment. Major efforts of the TRI-TAC Office included the overall coordination and evaluation of all equipments under development including interoperability, interface and configuration control. On 26 August 1976, the Director, TRI-TAC was designated the Executive Agent for developments of the Advanced Narrowband Digital Voice Terminals (ANDVT).

2. FY 1977 Program: The major activity is continuation of the level of effort required to support the mission of the Director, TRI-TAC Office. Major efforts will be expended in evaluating contractor performance during full scale development (FSD) of the AN/TTC-39 Switch, COMSEC (TENLEY) equipment, FSD for the Communications Nodal Control Element and Validation Phase for the System Control Element of the Technical Control Facility, FSD of the Family of DGM equipments, the Tropo Terminal and the UHF-TDMA equipment. Additional contracts to be awarded by the services include FSD for the Facsimile, Unit Level Switches (ULS) and COMSEC for the ULS. Review of all tactical communications programs and requirements including budgets will be continued as well as

Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A

Title Joint Tactical Communications (TRI-TAC) Program

Project #D104

Title Joint Tactical Communications (TRI-TAC) Office

interoperability, interface and configuration control. Direct and coordinate efforts, as Department of Defense (DOD) Executive Agent, in the initiation of the Advanced Narrowband Digital Voice Terminals (ANDVT) and related Communications Security (COMSEC) programs. Issue revised Program/Budget Guide for Program Objective Memorandum (POM) 79 (FY 79-83) for all TRI-TAC Research, Development, Test and Evaluation (RDTE), and Production procurement programs. Continue actions for for establishing Joint Test Element and Facility under the management of the Director, TRI-TAC Office.

3. FY 1978 Planned Program: Continuation of effort for all aspects of the TRI-TAC Program. Preparation of specification, coordination and monitoring of Service/National Security Agency (NSA) efforts, management of Joint Test Organization effort, interface and configuration control, and general overall program guidance. Increase in funds in FY 1978 over FY 1977 is due primarily to the start of joint testing on TRI-TAC equipment at Fort Huachuca, Arizona.

4. FY 1979 Planned Program: Continuation of program. The resources under this project will continue to support the cost of the operation of the TRI-TAC Office, to include civilian salaries, operating expenses, and support contract(s) in the accomplishment of the assigned mission as prescribed by DOD Directive 5148.7. Increase in funds over FY 1978 is due primarily to the continued build up of joint testing activities.

5. Program to Completion: This is a continuing program.

RESOURCES: (\$ in Thousands)

|             | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional to Completion</u> | <u>Total Estimated Cost</u> |
|-------------|----------------|----------------|----------------|----------------|----------------|---------------------------------|-----------------------------|
| RDTE: Funds | 4640           | 1224           | 5200           | 5499           | 5768           | Continuing                      | Not Applicable              |

FY 1978 ROUTE DESCRIPTIVE SUMMARY

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

Project #D110

Title Mobile Subscriber Equipment

Category Operational Systems

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The Mobile Subscriber Equipment (MSE) is a sub-system of the Mobile Subscriber Access (MSA) Communication System which is intended to meet military needs to communicate either while in motion or shortly after relocation, overcoming major limitations of the current Multi-Channel Area System. MSE provides mobile switching centers to interconnect mobile radio subscribers independent of a static multi-channel switched system. When within radio range, mobile radio subscribers will communicate directly obviating the need to use the central. Frequency spectrum utilization will be improved providing channel utilization on a priority basis. Automatic routing of calls using a fixed directory will provide users with a system similar to a mobile telephone.

RELATED ACTIVITIES: This TRI-TAC project involves participation of the other Services, Defense Communications Agency, and National Security Agency (NSA). There are specific related developments which will interface directly with MSE. These developments include the Army Single Channel Ground and Airborne Radio System (SINGARS), Marine Corps Unit Level Switch (ULS), and NSA Communications Security (COMSEC) program.

WORK PERFORMED BY: Project Manager, Multi-Services Communications Systems (FM, MSCS) and US Army Communications Research and Development Command, Fort Monmouth, New Jersey. There is no contract at this time.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Prior to FY 1974, the requirement for the system was under review by Training and Doctrine Command (TRADOC) as part of the Integrated Tactical Communications System (INTACS) study. In FY 1975, the INTACS study resulted in the emergence of the Net Radio Interface (NRI) and MSE as distinct subsets of the MSA. In FY 1976, the INTACS study was approved for implementation by the Vice Chief of Staff, US Army. A draft Joint Service Operational Requirement (JSOR) for MSE was prepared and coordinated within the Army. In FY 1977, Army requirements were consolidated in the draft JSOR for MSE and the document forwarded to HQ TRADOC for approval.



Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A Title Joint Tactical Communications Program (TRI-IAC)

Project #D110 Title Mobile Subscriber Equipment

2. FY 1977 Planned Program: Army requirements will be finalized for the Mobile Subscriber Equipment (MSE) during this period and coordination with the other Services will result in a Joint Chiefs of Staff (JCS) validated Joint Service Operational Requirement (JSOR). The preparation of specifications and procurement data for a Validation contract(s) will commence, with plans for award in early FY 1978.

3. FY 1978 Planned Program: The Validation contract(s) will be awarded to one or more contractors to investigate the technical alternatives, brass-board the critical areas and prepare performance specifications for the Full Scale Development (FSD) phase. Increase in FY 1978 funds over FY 1977 is due to award of the Validation contract(s).

4. FY 1979 Planned Program: The Validation phase will terminate and Source Selection Evaluation will result in one contractor entering Full Scale Development. The increase in FY 1979 funds over FY 1978 is due primarily to the Source Selection Evaluation and preparation for contract award activities plus Validation testing.

5. Program to Completion: Award Full Scale Development contract for fabrication, contractor testing and delivery of engineering development models. Complete Developmental/Operational Testing.

RESOURCES: (\$ in Thousands)

|             | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|-------------|---------|---------|---------|---------|--------------------------|----------------------|
| RDTE: Funds | 100     | 100     | 150     | 4968    | 96,202                   | 103,200              |
| Quantities* |         |         |         |         |                          |                      |

\*12 Engineering Development Models of NSF Equipment.



FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

Project #D111

Title Digital Group Multiplexer

Category Operational Systems

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is the development of a family of multiplexers, combiners, cable drive modems, pulse restorers, and group modems to be used in conjunction with the AN/TTC-39 Automatic Communications Central Office, Tactical Communications Control Facility (TCCF), Short Range Wideband Radio (SRWBR), Unit Level Switch, Radio Terminal and Radio Assemblage Program. The equipment will provide the capability to combine a group of subscribers on a single cable or radio system, combine groups into a single larger group for transmission up and down-the-hill from radio parks, and provide the necessary modems and restorers for larger capacity transmission systems.

RELATED ACTIVITIES: This project, as part of the TRI-TAC program, involves participation of the other Services, Defense Communications Agency, and the National Security Agency (NSA). There are specific related developments which will either use this equipment or interface directly with it. These developments include the Air Force TCCF, SRWBR program; the Marine Corps Unit Level Switch; the Army Radio Terminal and Radio Assemblage Programs, the AN/TTC-39 Program and the National Security Agency (NSA) TENLEY program.

WORK PERFORMED BY: Project Manager, Multi-Service Communications System (MSCS), and US Army Communications Research and Development Command, Fort Monmouth, New Jersey. Contractor is Raytheon Company, Sudbury, Massachusetts.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The competitive technical specifications and procurement package for the engineering development contract were prepared in conjunction with the other Services and the TRI-TAC office. The Determination and Findings (D&F) was approved on 1 November 1974, and the competitive Request for Proposal (RFP) was released on 18 November 1974. Proposals were received from industry and evaluated, and the contract was awarded in May 1975 to Raytheon Company. Preliminary and Final Design Reviews were conducted in November 1975 and July 1976 respectively. Design-Verification models were initiated. The review and acceptance of Contract Data Requirements List (CDRL) items was accomplished. The primary effort was coordinated with Army and other Service developments to effect the proper technical requirements. The review and approval of long lead items and the coordination of Integrated Logistics Support (ILS) continued. In FY 1977, the contractor's progress was monitored, spare parts identified, Design Verification models of most types were tested and progress continued toward release to manufacturing.
2. FY 1977 Program: Release to manufacturing will occur. The government will begin the acceptance of Pre-Prototype Qualification Test (PQT) models of equipment to be used by the Air Force during this FY. The contractor will assemble and initiate delivery of maintenance kits for the equipment support and prepare draft manuals.

Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

Project #D111

Title Digital Group Multiplexer

3. FY 1978 Planned Program: Pre-Prototype Qualification Testing (PQT) will be completed and equipment will be delivered to the government. Developmental Testing (DT) and Operational Testing (OT) will begin in the first quarter of the FY. Decrease in costs in FY 1978 compared to FY 1977 due to completion in FY 1977 of materials purchase and assembly of the majority of deliverables.

4. FY 1979 Planned Program: Testing and support by contractor to test program. Decrease in costs in FY 1979 compared to FY 1978 due to completion of deliveries in FY 1978.

5. Program to Completion: Completion of testing and support. Preparations for Low Rate Initial Production (LRIP).

6. Major Milestones:

|   | <u>Date</u> | <u>Estimated RDTE Cost to Reach Events (Cumulative)</u> |
|---|-------------|---|
| a. Engineering Development Contract Award     | May 75      | 500   |
| b. Final Design Review                        | Jul 76      | 10,506  |
| c. PQT Start                                  | May 77      | 20,562  |
| d. Equipment Deliveries                       | Mar 78      | 26,667  |
| e. Low Rate Initial Production Contract Award | Jan 80      | 27,680  |

RESOURCES: (\$ in Thousands)

| RDTE: Funds Quantities | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional to Completion</u> | <u>Total Estimated Cost</u> |
|------------------------|----------------|----------------|----------------|----------------|----------------|---------------------------------|-----------------------------|
|                        | 8170           | 2100           | 12055 *        | 4214 *         | 713            | 290                             | 27680                       |

\* All deliveries are scheduled for FY 77 and FY 78. Quantities are as follows: 36 Loop Group Multiplexers, 29 Trunk Group Multiplexers, 35 Master Group Multiplexers, 18 Remote Loop Group Multiplexers, 16 Remote Multiplexer Combiners, 37 Remote Loop Group Cable Combiners, 8 Cabler Order Wire Units, 79 Low Speed Modems, 31 High Speed Modems, 100 Low Speed Pulse Restorers, 80 High Speed Pulse Restorers, 48 Group Modems.

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

Project #D113

Title Super High Frequency Time Division Multiple Access (SHF TDMA) Modem

Category Operational Systems

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The Demand Assigned Super High Frequency Time Division Multiple Access (SHF TDMA) Modem Program was initiated to develop a modem for use in the Joint Tactical Communications Program (TRI-TAC) Land Based and Naval Tactical Command and Control and Switched Communications Systems. It is to operate in conjunction with all appropriate SHF ground, shipboard and shore terminals. It will provide secure multichannel trunking in these communications systems, interfacing with the AN/TTC-39 Switch and be compatible with TENLEY Communications Security (COMSEC) devices.

RELATED ACTIVITIES: This project as part of the TRI-TAC program is related to the AN/TTC-39, Unit Level Switch, Digital Group Multiplexer and the Ground Mobile Forces Satellite Terminals. Other Services, Defense Communications Agency and the National Security Agency are participants in this project.

WORK PERFORMED BY: US Army Satellite Communications Agency (SATCOMA), and the Project Manager, Multi-Service Communications System (MSCS), Fort Monmouth, New Jersey. A contractor will be selected late in FY 1977.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. FY 71, FY 1976, and Prior Accomplishments: A study effort by Communications Satellite Corporation completed in April of 1976, resulted in recommendations for a specification for Land Based and Naval modems utilizing Demand Assigned Time Division Multiple access techniques. Program planning, refinement and coordination of specification recommendations were accomplished and an Advance Procurement Plan was developed.
2. FY 1977 Program: Effort will be directed toward the award of a 24 month contract for six (6) Validation model modems. This award, scheduled for September 1977, will be preceded by a specification review, establishment and coordination of data requirements, developing and Integrated Logistics Support Plan, review of proposals and pre-award negotiations.
3. FY 1978 Planned Program: Continue Advanced Engineering, with review of Integrated Logistics Support and Contractor design. Preliminary and Final Design Reviews are planned during this period. Increase in FY 1978 funds over FY 1977 is due to incremental funding of 24 month contract awarded in late FY 1977.

**Budget Activity #4 - Tactical Programs**

Program Element #2.80.10.A

Title Joint Tactical Communications Program (JRI-TAC)

Project #D113

Title Super High Frequency Time Division Multiple Access (SHF TDMA) Modem

4. FY 79 Planned Program: Engineering and fabrication of models will be completed. Prototype Qualification Testing and delivery of equipment for Developmental/Operational Testing (DT/OT) will occur. Funding will continue at approximately the same level as in FY 78.

5. Program to Completion: Engineering Development Contract will be awarded, equipment delivered and DT/OT II Testing completed in 1983.

6. Major Milestones: (Advanced Development)

- a. Contract Award
- b. Preliminary Design Review
- c. Final Design Review
- d. Preliminary Qual Test
- e. Equipment Delivery

RESOURCES: (\$ in Thousands)

Estimated RDTE Cost to  
Reach Events (Cumulative)

1,676  
3,627  
4,700  
9,327  
11,827

Date

Sep 77  
Jan 78  
Apr 78  
Mar 79  
Sep 79

|             |         |         |         |         |                                |                            |
|-------------|---------|---------|---------|---------|--------------------------------|----------------------------|
|             | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
| RDTE: Funds | 100     | 125     | 900     | 6580    | 5183                           | 15285                      |



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

Project #D222

Title Automatic Communications Central Office AN/TTC-39

Category Operational Systems

Budget Activity #4 - Tactical Programs

**DETAILED BACKGROUND AND DESCRIPTION:** The Joint Tactical Communications (TRI-TAC) Program will provide a secure, automatically switched, multichannel tactical communications system for all US services in the early 1980's. It will interconnect with the Defense Communications System (DCS) and interface with systems of our allies. The first step in the development of program equipments was the tasking of the Army by the Assistant Secretary of Defense (Telecommunications) in January 1972 for the development of a hybrid analog/digital circuit and message switch to support the transition of the Services from an analog to an all digital environment. The development of this hybrid switch (AN/TTC-39) is pursued in this project.

**RELATED ACTIVITIES:** All Services, the Defense Communications Agency, and the National Security Agency are participating in the development of the AN/TTC-39 switch. Development efforts within the Army related to this program are conducted in Program Element 2.80.10.A D111, Digital Group Multiplexers; 2.80.10.A D113, Super High Frequency (SHF) Satellite Modem; and 2.80.10.A D110, Mobile Subscriber Access System. In addition, there are a number of TRI-TAC Tasks assigned to the other Services related to the AN/TTC-39. The Army program to monitor these other service efforts is 2.80.10.A D114, Other Service TRI-TAC. The TRI-TAC Office coordinates all Service efforts and is funded under 2.80.10.A D104.

**WORK PERFORMED BY:** Project Manager, Multi-Service Communications System; US Army Communications Research and Development Command; and TRI-TAC Office; all of Fort Monmouth, New Jersey. Contractor is GTE Sylvania, Needham Heights, Massachusetts.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: No hardware development was initiated prior to FY 1972, when a first draft of the Automatic Communications Central Office, AN/TTC-39 specification was developed, a final Joint Service Specification was approved and two competitive prototype contracts for advanced development (Phase I) were awarded. Development of the switch continued in 1973 during which time the competitive prototype contracts were monitored against the prototype model design plans which were submitted by the contractors. Data required for the engineering development (Phase II) contract to be awarded to the winner of Phase I was coordinated with the Services and agencies. The Coordinated Test Program was reviewed, and guidance for the Phase II proposal was developed. The Army was tasked to develop the Digital Group Multiplexer (DGM) family which is associated with the AN/TTC-39 switch. A successful Defense Systems Acquisition Review Council (DSARC) was held on 11 April 1974. Full Scale Development (FSD) was approved by the Deputy Secretary of Defense on 12 April 1974. A Cost Plus Incentive Fee (CPIF) contract was awarded to GTE Sylvania on 16 April 1974. The contract calls for sixteen engineering development models (9 circuit and 7 message switches). Twelve of the engineering development models to be used in testing, two for training and two used as glass



Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

Project #D222

Title Automatic Communications Central Office AN/TTC-39

case models to be retained at the contractor's plant. The Preliminary Design Review of the Full Scale Development (FSD) was held September 1974. In December 1974, the contractor announced a cost growth of \$23 million which was subsequently negotiated to reflect a \$19.1 million cost growth and a \$4.1 million change in scope. Through a series of TRI-TAC approved trade-off proposals in May of 1975, the proposals were incorporated into the contract baseline at a not-to-exceed cost of \$835K. The resultant Engineering Change Proposals caused a two month slippage in milestones starting with the Final Design Review. During November 1975, there were indications that the contractor was falling behind schedule because of problems in the completion of specifications and development of circuit switch software. At the Final Design Review held December 1975, the contractor identified a schedule slippage of 3 1/2 months. In order to provide the contractor with some time to resolve software problems, as well as to better align government testing of the AN/TTC-39 with the Tactical Communications Control Facility (TCCF) Program, the TRI-TAC Office authorized a 3 1/2 month extension of the program. A government study of the software problem concluded that there existed a potentially large slip in the program schedule. The contractor also confirmed a January 1976 government conclusion that cost growth was occurring that was not being reported. During May 1976, the contractor submitted an estimate of \$105.2M as the cost at completion against the schedule presented at the December 1975 Final Design Review. Government analysis of this estimate resulted in a conclusion that a breach of Decision Coordinating Paper (DCP) 135 cost and schedule thresholds was to be anticipated. In June 1976, the Project Manager recommended a review of the development program by Defense Systems Acquisition Review Council (DSARC) principals. The contractor's funding requirements submitted in May 1976 for FY 1977 and FY 1978 exceeded available program funding. During August 1976, the contractor was directed to implement a plan which minimized government exposure to further cost growth, pending a decision on the future of the development program. The directed action constrains the development effort through FY 1977 within a cumulative funding cap of \$96.0M. This plan is contained as one of the program alternatives in a revision to DCP 135.

2. FY 1977 Program: Pending DSARC decision on the restructure of the program baseline, contractual efforts will be directed toward completion of development and start of Prototype Qualification Test (PQT) for the Message Switch. Development effort will continue on the circuit switch software.

3. FY 1978 Planned Program: Completion of PQT and start of Development Test and Evaluation/Initial Operational Test and Evaluation (DTE/IOTE) for the Message Switch and start of PQT for the Circuit Switch. Increase in FY 1978 over FY 1977 due to restructured program baseline resulting from 2 November 1976 DSARC program decision.

4. FY 1979 Planned Program: Completion of PQT and start of DTE/IOTE for Circuit Switch. Decrease in funds in FY 1979 compared to FY 1978 due primarily to completion for engineering, assembly and PQT of Circuit Switch. Start of DTE/IOTE on the Circuit Switch and continuation of DTE/IOTE on the Message Switch are major tasks during FY 1979.

Budget Activity #4 - Tactical Programs

Program Element #2.80.10.A

Title Joint Tactical Communications Program (TRI-TAC)

Project #D222

Title Automatic Communications Central Office AN/TTC-39

5. Program to Completion: Conduct and completion of Development Test and Evaluation/Initial Operational Test and Evaluation (DTE/IOTE). Conduct of a Special In-Process Review (IPR) as a pre-requisite to award of Long Lead Items (LLI) for Low Rate Initial Production (LRIP), and a TRI-TAC chaired economic analysis to support Defense Systems Acquisition Review Council (DSARC) III.

6. Major Milestones:\*

|   | Date                       | Estimated RDTE Cost to Reach Events (Cumulative) | 24.0M (sunk cost, validation phase) |
|---|----------------------------|--|-------------------------------------|
| a. Engineering Development Contract Award | April 1974                 |  |                                     |
| b. Prototype Qualification Test (PQT)     |                            |  |                                     |
| Complete Message Switch                   | April 1978                 | 153.4M   |                                     |
| Complete Circuit Switch                   | November 1978              | 172.4M   |                                     |
| c. DTE/IOTE                               |                            |  |                                     |
| Start                                     | July 1978                  | 160.0M   |                                     |
| Complete                                  | November 1979              | 184.4M   |                                     |
| d. LLI Award                              | November 1979              | 202.0M   |                                     |
| e. DSARC III                              | 3Q 1980                    | 202.0M   |                                     |
| f. LRIP Award                             | DSARC III plus one month   | 202.0M   |                                     |
| g. DSARC III A                            | 4Q 1982                    | 202.0M   |                                     |
| h. Full Scale Production Award            | DSARC III A plus one month | 202.0M   |                                     |
| i. Initial Operational Capability (IOC)   | 2Q 1982                    | 202.0M   |                                     |

\* Alternative C Decision Coordinating Paper (DCF) #135 Revised 15 November 1976.

RESOURCES: (\$ in Thousands)

|             | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|-------------|---------|---------|---------|---------|--------------------------|----------------------|
| RDTE: Funds | 46095   | 6208    | 18023   | 25473   | 3346                     | 181700               |
| Quantities  | 0       | 0       | 0       | 0       | Net Applicable           | 16**                 |

\*\* Engineering Development Models.

Budget Activity #4 - Tactical Program

Program Element #2.80.10.A

Project #D222

Title Joint Tactical Communications Program (TRI-TAC)

Title Automatic Communications Central Office AN/TTC-39

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: The contractor for the AN/TTC-39 is GTE Sylvania. A combined Development Test and Evaluation and Initial Operational Test and Evaluation (DTE/IOTE) is scheduled to commence in July 1978. The test will continue through November 1979. Primary test site is Fort Huachuca, Arizona. The final Development Test and Evaluation/Initial Operational Test and Evaluation Joint Test Plan was forwarded on 27 February 1975 for Office of Secretary of Defense (OSD) review and coordination. The test design was considered adequate by OSD.

2. Operational Test and Evaluation: No operational tests have been conducted on the AN/TTC-39. A joint DTE/IOTE is scheduled for July 1978 - November 1979 at Fort Huachuca, Arizona and Davis Monthan AFB, Arizona. It is expected that the Engineering Development equipment to be tested will be essentially the same as the production models although the switch modularity may vary according to specific employment of production equipment. Contractor support will continue during the testing. Reliability and Maintainability is an important part of the test program and will be evaluated during the test in accordance with the criteria currently being approved as part of the test plan.

3. System Characteristics:

Circuit Switch (750 Terminations)/(300 Line)

Inherent Availability  
Mean Time Between Failure  
Mean Time to Repair  
Simultaneous Conference  
Maximum Conferences per Conference  
Alternate Routing  
Standby Battery Power  
Terminations per Module  
Maximum Weight per Shelter

.9999/.999  
2500 hours/250 hours  
15 minutes  
6/4  
20  
Up to 5  
15 minutes  
150  
7000 lbs

Message Switch (50 line)

Inherent Availability  
Mean Time Between Failure  
Mean Time to Repair  
Reference Storage  
Journal Storage

.9999  
2500 hours  
15 minutes  
10 days  
30 days

Demonstrated Performance 1/

Budget Activity #4 - Tactical Program

Program Element #2.80.10.A

Project #D222

System Characteristics:

Standby Battery Power  
Message Processing Time  
Throughput Characters per Second  
Bit Error Rate per Consecutive Bits  
Maximum Weight per Shelter

Title Joint Tactical Communications Program (TRI-TAC)

Title Automatic Communications Central Office AN/TTC-39

Objective

15 minutes  
2 seconds  
9000  
1 per 10<sup>10</sup>  
7000 lbs

Demonstrated Performance 1/

1/ Testing is scheduled to begin in July 1978. No performance characteristics have been tested to date.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #3.31.42.A

Title Satellite Communications Ground Environment

Category Operational Systems

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number         | Title  | TOTAL FOR PROGRAM ELEMENT Quantities* | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost |
|------------------------|--|---------------------------------------|---------|---------|---------|---------|-------------------------------------|----------------------|
|                        |  |                                       |         |         |         |         |                                     |                      |
|                        |  |                                       | 9981    | 2735    | 13280   | 17000   |                                     | Not Applicable       |
| D253                   | Defense Satellite Communications Systems-Defense Communications System (DSCS-DCS) (Phase II) | 4741                                  | 1250    | 4592    | 9600    | 12000   | Continuing                          | Not Applicable       |
| D450                   | Satellite Communications   | 600                                   | 250     | 800     | 485     | 500     | Continuing                          | Not Applicable       |
| D456                   | Tactical Satellite Communications (TACSATCOM)  | 4640                                  | 1235    | 3360    | 3195    | 4500    | Continuing                          | Not Applicable       |
| Procurement:           |  |                                       |         |         |         |         |                                     |                      |
|                        | Funds  | 80300                                 | 6500    | 118900  | 72200   | 149200  | Continuing                          | Not Applicable       |
|                        | Quantities*  |                                       |         |         |         |         |                                     |                      |
| Military Construction: |  |                                       |         |         |         |         |                                     |                      |
|                        |  | 1387                                  | 0       | 1542    | 2234    | 1559    | Continuing                          | Not Applicable       |

\* Large number of diverse items.

BRIEF DESCRIPTION OF ELEMENT: This program includes the development of strategic and tactical ground terminals for use with satellite communications systems.

BASIS FOR FY 1978 RDTE REQUEST: Project D253: Complete test of Pilot Control Subsystem. Complete engineering development of Initial Polling Order Wire Modem. Initiate and complete engineering development of Burst Error Correction Equipment. Complete advanced development of Pseudo Noise/Time Division Multiple Access (PN/TDMA). Continue engineering development of the Low Rate Multiplexer. Initiate engineering development of the TD-1192 Demand Assignment Appliance. Initiate engineering development of the Small Recoverable Terminal. Initiate development of the Interim Control Subsystem. Project D450: Type classify Ultra High Frequency (UHF) Manpack (AN/PSC-1). Award engineering development contract for Control/Network Modem. Project #450: Continue Millimeter wave, 40 Megabit Coder, Antenna Patterns, and frequency investigation efforts.



#### Budget Activity #4 - Tactical Programs

##### Program Element #3.31.42.A

##### Title Satellite Communications Ground Environment

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The funding in FY 1978 for Project D253 is increased to initiate development of several modems and multiplexers necessary for the full implementation of the Defense Satellite Communications System (DSCS) Program. In addition, funds are necessary for the Interim Adaptive Control System and to incrementally fund existing contractual requirements at planned levels of effort.

##### PERSONNEL IMPACT:

##### TERMINATION COST: (\$ in Thousands)

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |                       | FY 1977<br>and<br>Prior | FY 1978 | Total  |
|----------------------------|------|-------------|-------|-----------------------|-------------------------|---------|--------|
| (1) Federal Civ. Employees | 80   | 0           | 80    | (1) Estimated Govern- | 135033                  | 1500    | 136533 |
| (2) Contractor Employees   | 289  | 1031        | 1320  | ment Liability        |                         |         |        |
|                            |      |             |       | Financed with:        |                         |         |        |
| Total                      | 369  | 1031        | 1400  |                       |                         |         |        |

DETAILED BACKGROUND AND DESCRIPTION: This program includes the development of strategic and tactical ground terminals for use with satellite communications systems. The two major projects included in this program element are: The Defense Satellite Communications System (DSCS) Phase II and the Tactical Satellite Communications System (TACSATCOM). Ground terminals for all of the Services are developed within these projects. Some of the efforts to advance those technological areas necessary to improve the ground environment of the DSCS program, and to develop satellite communications equipments suitable for TACSATCOM and other satellite applications, are conducted in a third, and smaller project, Satellite Communications.

RELATED ACTIVITIES: Management of the Army TACSATCOM program is vested in the Project Manager, Satellite Communications, Fort Monmouth, New Jersey. The Army is responsible for ground terminal development for all Services. The Defense Communications Agency (DCA) is the program manager for the DSCS. In the DSCS, the Army is responsible for development of the ground environment. The Air Force is responsible for the development and launching of the satellites and the Navy for the development of shipboard terminals.

WORK PERFORMED BY: The US Army Satellite Communications Agency, Fort Monmouth, New Jersey. Contractors include: Aeronutronics-Ford, Palo Alto, California; Raytheon Company, Sudbury, Massachusetts; Magnavox Research Labs, Torrance, California; RCA, Camden, New Jersey; Linkabit Corporation, San Diego, California; Harris Corporation, Melbourne, Florida; Martin-Marietta Corporation, Orlando, Florida; Electronic Communications, Inc., St. Petersburg, Florida; and Cincinnati Electronics, Cincinnati, Ohio. Sixteen additional contracts costing \$6.8 million are awarded under this program.

Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A Title Satellite Communications Ground Environment

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Defense Satellite Communications System (DSCS): The Phase I DSCS became operational in July 1967 and was composed of 26 satellites, 16 Heavy Terminals and 13 Medium Terminals. In FY 1969, the capability was developed and made operational for transmission of high resolution photographic data. In FY 1970, a Heavy Terminal engineering development contract was awarded, followed in FY 1972 by an engineering development contract for Line Division Multiple Access (LDMA) equipment, and in FY 1973 for engineering development for the AN/USC-28 Spread Spectrum Modem equipment and the Light Terminal. During FY 1973, the Heavy Terminal development was completed. In FY 1974, an engineering development contract was awarded for Quadra-Phase Shift Keying (QPSK) equipment. The QPSK equipment is a major element in a digital communications subsystem under fabrication by the Tobyhanna Army Depot in support of the Heavy Terminal, which is in production. Completed in FY 75 were development of the QPSK equipment, the Light Terminal, the Heavy Terminal, and TDMA. In FY 1976, the Time Division Multiple Access (TDMA) equipment was incorporated with a Pseudo Noise feature which became the PN/TDMA development effort and the focal point of the DSCS of the 1980's. In FY 1975, developments were initiated for a gain/temperature (G/T) 34 dB antenna for the Medium Terminal, a G/T 26 dB antenna for the Light Terminal, and a Pilot Control Subsystem. In FY 1976, the development of the G/T 34 dB was completed. In FY 77 development continued on the PN/TDMA, Pilot Control Subsystem, and the AN/USC-28 Spread Spectrum equipment. Tactical Satellite Communications System (TACSATCOM): As the result of a Joint-Service Program, the Army and the Air Force contracted for Advanced Development models of ground and airborne terminals in the Ultra High Frequency (UHF) and the Super High Frequency (SHF) spectrums. Test results proved the feasibility of using satellite communications to meet tactical requirements. A Systems Development Plan was prepared and an In-Process Review (IPR) held in August 1971. In December 1972, an Engineering Development contract was awarded to RCA Corporation, Camden, New Jersey for SHF ground terminals in 1/4 ton trailer and 1 1/4 ton truck configuration. In 1974, the SHF terminal contract was continued and contracts were awarded for the SHF/UHF Communications Control Facility; UHF antennas; TACSAT Signal Processor and the UHF Manpack Transceiver. In FY 1975, request for quotations (RFO) where released for the Control/Network terminal modem, and completed development and initiated development/operational testing (DT/OT II) on SHF terminals and TACSAT Control Terminal. In FY 1976, development test II/operational test II on Super High frequency (SHF) terminals and control facility was completed. A Development Acceptance (DEVA) IPR was held on the SHF terminals, Type Classification-Limited procurement obtained and a Low-Rate-Initial-Production contract awarded. Contracts continued on UHF manpack transceivers and the Control/Network terminal modems. Awarded contract for feasibility model of a Digital Message Device for use with UHF terminals. In FY 77, continued contracts on UHF Manpack Transceivers, Control/Network Terminal Modems, and Digital Message Device. Satellite Communications: In the Satellite Communications project in FY 1974, a contract was awarded for the Millimeter

Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A Title Satellite Communications Ground Environment

Wave Antenna. In FY 1975, the Millimeter Wave Antenna contract was completed. Investigations were initiated on the Peak Power Amplifier and Ground Mobile Forces Satellite System. Initiated testing of Airborne Transceiver. In FY 1976, continued Millimeter Wave and Airborne terminal developments and awarded contracts for Peak Pulse Power Amplifier and Dual Modems. In FY 1977, continued Millimeter Wave, Peak Pulse Power Amplifier, and Dual Modem development.

2. FY 1977 Program: Defense Satellite Communications System (DSCS): Complete development of the AN/USC-28 Spread Spectrum equipment. Continue development of Pseudo Noise/Timer Division Multiple Access (PN/TDMA) and Pilot Control. Initiate development of the Initial Polling Order Wire Modem and Burst Error Correction equipment. Initiate Design Approach contracts for the Low Rate Multiplexer, the AN/USC-28 Compatible Modem, and the TD-1192 Demand Assignment Applique. Complete development of G/I 26 antenna. Tactical Satellite Communications System (TACSATCOM): Award contract to Cincinnati Electronics for Maintenance Package for Ultra High Frequency (UHF) Manpack. Complete contract for UHF Manpack Transceivers, Control/Network Terminal Modem, and Digital Message Device. Complete Developmental Testing/Operational Testing II (DT/OT II) on UHF Manpack Transceivers, and DT/OT I on Control/Network Terminal Modem. Award depot support contract for UHF Manpack Transceiver. Conduct Development Acceptance In-process Review (DEVA IPR) on SHF Communications Control Facility. Satellite Communications: Complete Millimeter Wave development of 30 GHz receiver and see through Traveling Wave Tube (TWT) and initiate effort on a 30 GHz transmitter. Complete Peak Pulse Power Amplifier effort.

3. FY 1978 Planned Program: DSCS: Complete test of Pilot Control Subsystem. Complete Engineering Development of Initial Polling Order Wire Modem. Initiate and complete Engineering Development of Burst Error Correction Equipment. Complete Advanced Development of PN/TDMA. Continue Engineering Development of the Low Rate Multiplexer. Initiate Engineering Development of the Bandwidth Efficient Modem. Initiate Engineering Development of the TD-1192 Demand Assignment Applique. Initiate Engineering Development of the Small Recoverable Terminal. Initiate development of the Interim Control Subsystem. TACSATCOM: Complete DEVA-IPR and Type Classification actions on UHF Manpack Transceivers and award production contract. Continue depot support contract on UHF Manpack Transceiver. Award Engineering Development contract for Control/Network Terminals Modems. Award Advanced Development contract for Low-Power Peak-Power Amplifiers. Satellite Communications: Complete 30 GHz Transmitter, 40 megabit coder, antenna patterns, and frequency investigation efforts. Increase in FY 1978 funds over FY 1977 is due to initiation of above contractual efforts in the DSCS.

4. FY 1978 Program: DSCS: Initiate Engineering Development of Pseudo Noise/Timer Division Multiple Access (PN/TDMA). Complete Engineering Development of Low Rate Multiplexer and TD-1192 Demand Assignment Applique. Continue Engineering Development of Small Recoverable Terminal and Interim Control Subsystem. Initiate development of the AN/USC-28 Compatible Modem. Initiate a Design Approach for Experimental K-Band Terminals. TACSATCOM: Continue contracts for Control/Network Terminal Modems and Low-Power Peak-Power Amplifiers. Award Advanced Development contract for an SHF Single Channel Economical Small Terminal. Satellite Communications: Initiate testing of Millimeter Wave Equipment. Increase in FY 1979 funds over FY 1978 is due to incremental funding of continued and initiated contractual efforts in DSCS.

Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A Title Satellite Communications Ground Environment

5. Program to Completion: This is a continuing program.

6. Major Milestones:

TACSATCOM:

AN/TSQ-118 Development Acceptance In-Process Review (DEVA IPP) - Super  
 High Frequency (SHF) Communications Control Facility  
 AN/MSC-64/65 Award Production Contract - Ultra High Frequency (UHF) Terminal  
 AN/PSC-1 Complete Developmental Testing/Operational Testing II (DT/OT II) -  
 UHF Manpack  
 AN/PSC-1 DEVA IPR - UHF Manpack  
 AN/PSC-1 Award Production Contract - UHF Manpack  
 AN/TSC-85/93 Award Full Production Contract - SHF Terminal

DSCS

AN/FSC-78 Complete RDTE - Heavy Terminal  
 AN/USC-28 Complete DT/OT - SHF Communications Control Facility

Estimated RDTE Cost to  
 Reach Events (Cumulative)

Date

|        |       |
|--------|-------|
| Dec 76 | 13600 |
| Jun 77 | 17200 |
| Aug 77 | 17200 |
| Jan 78 | 17200 |
| Jun 78 | 17200 |
| Jun 79 | 17200 |
| Dec 76 | 6700  |
| Jun 77 | 10200 |



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #3.31.42.A

Title Satellite Communications Ground Environment

Project #D253

Title Defense Satellite Communications System - Defense Communications System (Phase II)

Category Operational Systems

Budget Activity #4 - Tactical Programs

**DETAILED BACKGROUND AND DESCRIPTION:** The Initial Defense Communications Satellite Project (IDCSP) was initiated in 1962 to support research and development in military satellite communications and to provide a limited operational capability. Investigation of satellite communications was necessary to improve service, quality, capacity and reliability of segments of the Defense Communications System (DCS); provide contingency communications required during a crisis or limited war; and provide communications for high priority users. The IDCSP evolved into the Phase I, Defense Satellite Communications System (DSCS) which became operational in 1967. To improve the capacity, reliability, and quality of the system, Phase II, DSCS, was approved in June 1968 and the program initiated in FY 1969. Phase II, DSCS employs new satellites, terminals, modulation and equipment. In the DSCS project, the Army develops the satellite ground terminals and associated equipment in response to requirements developed by the Defense Communications Agency (DCA). The DSCS ground complex (Phase I) consists of two types of terminals--the Heavy and Medium Terminals. In Phase II, DSCS, the Army is developing new Heavy, Medium, and Light Terminals, and associated modulation equipment, with high capacity and reliability. These terminals are required to satisfy known and contingency operational needs of the worldwide Military Command and Control System (MCMCS), the National Communications System (NCS), and other elements of the DCS.

**RELATED ACTIVITIES:** The DCA is the DSCS Program Manager. In the DSCS, the Army is responsible for the development of the ground environment, the Air Force is responsible for the development and launching of the satellite, and the Navy is responsible for the development of the shipboard terminals. One element of the DCS program, development of the new Light Terminal, is being performed via a contract awarded in this program under the Tactical Satellite Communications (TACSATCOM) Project 3.31.42.A, D456. Funding is being provided from this project, D253.

**WORK PERFORMED BY:** The US Army Satellite Communications Agency, Fort Monmouth, New Jersey, has been designated the project office for the development of the ground complex of the DSCS. The commander of the agency is the project manager. The primary contractors for the Phase II system are: Aeronutronics-Ford Corporation, Western Development Laboratories Division, Palo Alto, California, for the Heavy Terminals; Raytheon Company, Sudbury, Massachusetts, for the Time Division Multiple Access (TDMA) equipments; Magnavox Research Laboratories, Torrance California, for the Spread Spectrum modulation equipment; and Linkabit Corporation, San Diego, California, for encoder/decoder equipment. Light Terminals are being developed as part of a contract with Radio Corporation of America.



Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A

Title Satellite Communications Ground Environment

Project #0253

Title Defense Satellite Communications System - Defense Communications System (Phase II)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The Phase I Defense Satellite Communications System (DSCS) became operational in July 1967 and was composed of 26 satellites, 16 Heavy Terminals, and 13 Medium Terminals. In FY 1969, the capability was developed and made operational for transmission of high resolution photographic data. In FY 1970, a contract was awarded for Engineering Development of a Heavy Terminal, followed in FY 1972 by an Engineering Development contract for Time Division Multiple Access (TDMA) and in FY 1973 for Engineering Development of the AN/USC-28 Spread Spectrum equipment and the Light Terminal. In FY 1974 an Engineering Development contract was awarded for Quadra-Phase Shift Keying (QPSK) equipment. The Heavy Terminal, Light Terminal, TDMA, and QPSK developments were completed by FY 1975. The QPSK equipment is a major element in a Digital Communications Subsystem under fabrication by Tobyhanna Army Depot in support of the Heavy Terminal (AN/FSC-78) which is in production. The TDMA equipment became the basis for development of Pseudo Noise/Time Division Multiple Access (PN/TDMA) equipment, the contract for which was awarded in FY 1976. PN/TDMA is the focal point for the DSCS of the 1980's. Developments were initiated in FY 1975 for G/T 34 and G/T 26 antennas for use with the Medium and Light Terminals respectively. The G/T 34 antenna development was completed in FY 1976.
2. FY 1977 Program: Complete development of the AN/USC-28, continue development of PN/TDMA and Pilot Control, initiate development of the Initial Polling Order Wire Modem, and Burst Error Correction equipment. Initiate Design Approach contracts for the Low Rate Multiplexer, the AN/USC-28 Compatible Modem, and the TD-1192 Demand Assignment Applique. Complete development of G/T 26 Antenna.
3. FY 1978 Planned Program: Complete Engineering Development of Initial Polling Order Wire Modem. Initiate and complete Engineering Development of Burst Error Correction Equipment. Complete Advance Development of PN/TDMA. Continue Engineering Development of the Low Rate Multiplexer. Initiate Engineering Development of the Bandwidth Efficient Modem. Initiate Engineering Development of the TD-1192 Demand Assignment Applique. Initiate Engineering Development of the Small Recoverable Terminal. Initiate development of the Interim Control Subsystem. Complete test of Pilot Control Subsystem. Increase in FY 1978 funds over FY 1977 is due to initiation of above contractual efforts.
4. FY 1979 Planned Program: Initiate Engineering Development of PN/TDMA. Complete Engineering Development of Low Rate Multiplexer and TD-1192 Demand Assignment Applique. Continue Engineering Development of Small Recoverable Terminal and Interim Control Subsystem. Initiate Development of the AN/USC-28 Compatible Modem. Initiate a Design Approach for experimental K-Band Terminals. Increase in FY 1979 funds over FY 1978 is due to incremental funding of continued initiated contractual efforts.
5. Program to Completion: This is a continuing program. The research and development in this project provides for the improvement in equipment of an operational system as directed by the Defense Communications Agency.

Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A

Project #D253

Title Satellite Communications Ground Environment

Title Defense Satellite Communications System - Defense Communications System (Phase II)

6. Major Milestones:

AN/TSC-86 Light Terminal  
Complete Developmental/  
Operational Testing II  
Type Classify  
Award Production Contract

Date Estimated RDTE Cost to  
Reach Events (Cumulative)

Dec 76 3600  
Jan 77 3600  
Mar 77 3600

RESOURCES: (\$ in Thousands)

|                               | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|-------------------------------|---------|---------|---------|---------|--------------------------------|----------------------------|
| RDTE: Funds                   | 4741    | 1250    | 9600    | 12000   | Continuing                     | Not Applicable             |
| Quantities: *                 |         |         |         |         |                                |                            |
| Procurement:                  |         |         |         |         |                                |                            |
| Funds:                        | 53600   | 6500    | 56200   | 94600   | Continuing                     | Not Applicable             |
| Quantities *                  |         |         |         |         |                                |                            |
| Military Constructions Funds: | 1387    | 0       | 2234    | 1559    | Continuing                     | Not Applicable             |

\* Large numbers of diverse items.

Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A

Title Satellite Communications Ground Environment

Project #D253

Title Defense Satellite Communications System - Defense Communications System (Phase II)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. Development contractors are the same as those shown in the paragraph of this report entitled "WORK PERFORMED BY." For the program shown in this RDT&E Descriptive Summary, the only development testing that has occurred has been the testing of the AN/FSC-78 Heavy Terminal (formerly the AN/MSC-60). This is a new terminal which does not replace any other terminals. There were no major discrepancies or deficiencies or resulting corrective actions. The terminal was found to be highly reliable and easily maintainable.

b. Developmental Testing II (DT II) testing for the AN/TSC-86 Light Terminal was completed in November 1975 by the US Army Satellite Communications Agency (USASATCOMA).

c. DT II testing for the AN/MSC-61 Medium Terminal was completed in September 1976 by USASATCOMA.

2. Operational Test and Evaluation:

a. An Operational Test II (OT II) was conducted on the AN/FSC-78 at Fort Detrick, MD by US Army Communications Command (USACC) during the period January - April 1974. As a result of this test the AN/FSC-78 was Type Classified Standard in April 1974.

b. Operational Test III (OT III) was conducted during the period October 1976 - January 1977 at Sunnyvale, CA, using the Air Force AN/FSC-78 Terminal. USACC conducted the test. The test was monitored by US Army Operational Test and Evaluation Agency (OTEA).

c. Operational Test II (OT II) for the AN/TSC-86 conducted during the period December 1975 - February 1976 at Fort Huachuca, AZ by the US Army Communications Command.

d. Operational Test II (OT II) for the AN/MSC-61 was conducted during October 1976 - December 1976 at Fort Monmouth, NJ and Fort Huachuca, AZ by USACC.

Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A

Project #D253

Title Satellite Communication Ground Environment

Title Defense Satellite Communications System - Defense Communications System (Phase II)

3. SYSTEM CHARACTERISTICS:

| Item                         | Antenna<br>Size | Frequency<br>Band | Power<br>Amplifiers | Down<br>Converters | Up<br>Converters |
|------------------------------|-----------------|-------------------|---------------------|--------------------|------------------|
| AN/FSC-78 Heavy<br>Terminal  | 60 ft.          | SHF               | 2-5 kilowatts       | 15 maximum         | 9 maximum        |
| AN/TSC-86 Light<br>Terminal  | 8 ft.           | SHF               | 2-1 kilowatts       | 4 maximum          | 4 maximum        |
| AN/NSC-61 Medium<br>Terminal | 38 ft.          | SHF               | 2-5 kilowatts       | 15 maximum         | 9 maximum        |

# FY 1978 RDTE DESCRIPTIVE SUMMARY

|                 |                     |                 |   |
|-----------------|---------------------|-----------------|---|
| Program Element | #3.31.42.A          | Title           | Satellite Communications Ground Environment |
| Project         | #D-56               | Title           | Tactical Satellite Communications           |
| Category        | Operational Systems | Budget Activity | #4 - Tactical Programs                      |

DETAILED BACKGROUND AND DESCRIPTION: The Army, along with the other Services, requires a family of manpack and mobile Tactical Satellite Communications (TACSATCOM) terminals to improve the effectiveness and reliability of the communications equipment to meet selected tactical requirements. The objectives of this program are: (a) to design and build development test/operational test (DT/OT) models of tactical communications terminals; (b) to develop operational concepts; (c) to support military operational needs. This equipment will replace existing equipment where it is more cost effective or fulfills essential military requirements that are not being accomplished by other means.

RELATED ACTIVITIES: Management of the Army TACSATCOM Program is vested in the Project Manager, Satellite Communications, Fort Monmouth, New Jersey. The Army is responsible for ground terminal development for all Services. Similarly, the Air Force and Navy are developing airborne and shipborne terminals respectively. The Air Force is also responsible for the development and launching of required satellites for all Services.

WORK PERFORMED BY: The US Army Satellite Communications Agency, Fort Monmouth, New Jersey, is the project office for the development and procurement of all ground terminals for the Services. Contractors include: RCA, Camden, New Jersey; Electronic Communications, Inc., St. Petersburg, Florida; Harris Corporation, Melbourne, Florida; Martin Marietta Corporation, Orlando, Florida; and Cincinnati Electronics, Cincinnati, Ohio.

## PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: As a result of a Joint-Service Program, the Army and the Air Force contracted for advanced development models of ground and airborne terminals in the Ultra High Frequency (UHF) and Super High Frequency (SHF) spectrums. Test results proved the feasibility of using satellite communications to meet tactical requirements. A system Development Plan was prepared and an In-Process Review held in August 1971. In December 1972, an Engineering Development contract was awarded to RCA Corporation, Camden, New Jersey, for SHF ground terminals in 1/4 ton trailer and 1 1/4 ton truck mounted shelter terminals. In FY 1974, the RCA SHF small terminal contract was expanded to include an Engineering Development model of an SHF Communications Control Facility. Engineering Development contracts were awarded for UHF Antennas to Harris Corporation, Melbourne, Florida; TACSAT Signal Processor (TSSP) to Martin Marietta Corporation, Orlando, Florida; and UHF Manpack Transceiver to Cincinnati Electronics, Cincinnati, Ohio. An Advanced Development contract was awarded for a Control/Network Terminal Model with Harris Corporation, Melbourne, Florida. Contracts completed include: SHF terminals; UHF antenna; SHF Communications Control Facility;



#### Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A

Title Satellite Communications Ground Environment

Project #D456

Title Tactical Satellite Communications

and TACSAT Signal Processor. In FY 1976, Development Test II (DT/OT II) on Super High Frequency (SHF) terminals and Control Facility was completed, a Development Acceptance In-Process Review (DEVA IPR) was held on the SHF terminals, Type Classification-Limited procurement obtained and a Low-Rate-Initial-Production contract awarded, contracts continued on Ultra High Frequency (UHF) Manpack Transceivers and for Control/Network terminal modems, and awarded contract for feasibility model of a Digital Message Device for use with UHF terminals. In FY 1977, contracts continued on UHF Manpack Transceivers, Control/Network Terminal Modems, and Digital Message Device.

2. FY 1977 Program: Award contract to Cincinnati Electronics for Maintenance Package for UHF Manpack. Complete contract for UHF Manpack Transceivers, Control/Network Terminal Modem, and Digital Message Device. Complete DT/OT II on UHF Manpack Transceivers, and DT/OT I on Control/Network Terminal Modem. Award depot support contract for UHF Manpack Transceiver. Conduct DEVA IPR on SHF Communications Control Facility.

3. FY 1978 Planned Program: Complete DEVA IPR and Type Classification actions on UHF Manpack Transceivers and award production contract. Continue depot support contract on UHF Manpack Transceiver. Award Engineering Development contract for Control/Network terminals modems. Award Advanced Development contract for Low-Power Peak-Power Amplifiers. The decrease in FY 1978 funds from FY 1977 is due to less contractual effort on the UHF Manpack.

4. FY 1979 Planned Program: Continue contracts for Control/Network Terminal Modems and Low-Power Peak-Power Amplifiers. Award Advanced Development contract for an SHF Single Channel Economical Small Terminal. The increase in FY 1979 funds over FY 1978 is due to contractual effort on the SHF Single Channel Economical Small Terminal.

5. Program to Completion: This is a continuing program. Completion of all Engineering Development contracts, DT/OT and integration of the family of terminals into the Army inventory remains to be accomplished. Related Research and Development efforts in the area of modems, exciter drivers, etc., will continue geared toward more efficient use of satellite power.

#### 6. Major Milestones:

|              | Date   | Estimated RTE Cost to Reach Events (Cumulative) |
|--------------|--------|---|
| AN/TSQ-118   | Dec 76 | 13600   |
| AN/MSC-64/65 | Jun 77 | 17200   |
| AN/PSC-1     | Aug 77 | 17200   |
| AN/PSC-1     | Jan 78 | 17200   |
| AN/PSC-1     | Jun 78 | 17200   |
| AN/TSC-85/93 | Jun 79 | 17200   |

Budget Activity #4 - Tactical Programs

Program Element #3.31.42.A

Project #D456

RESOURCES: (\$ in Thousands)

RDTE: Funds Quantities: AN/PSC-1 Ultra High

Frequency (UHF)  
Manpack  
Control/Net Modem  
AN/TSC-85 Super High  
Frequency (SHF)  
Terminal  
AN/MS-59 SHF Terminal  
AN/TSQ-118 SHF Commu-  
ications Control  
Facility

| FY 1976 | FY 1977 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|---------|---------|---------|---------|---------|--------------------------------|----------------------------|
| 4640    | 1235    | 3360    | 3195    | 4500    | Continuing                     | Not Applicable             |

Procurement:  
Funds

Quantities:

AN/TSC-85 SHF Terminal  
AN/TSC-93 SHF Terminal  
AN/TSQ-118 SHF Commu-  
ications Control Facility  
AN/MS-64 UHF Terminal  
AN/MS-65 UHF Terminal  
AN/PSC-1 UHF Manpack

|       |   |       |       |       |            |                |
|-------|---|-------|-------|-------|------------|----------------|
| 26700 | 0 | 20700 | 16000 | 54600 | Continuing | Not Applicable |
| 3     |   | 9     |       | 6     |            |                |
| 10    |   |       |       | 7     |            |                |
|       |   | 4     | 62    | 140   |            |                |
|       |   | 20    |       |       |            |                |
|       |   | 8     |       | 72    |            |                |

Title Satellite Communications Ground Environment

Title Tactical Satellite Communications

FY 1978 RDTE DESCRIPTIVE SUMMARY

|                              |   |  |  |  |  |
|------------------------------|---|--|--|--|--|
| Program Element #3.31.45.A   | Title European Command, Control and Communications Systems (EUCOM C <sup>3</sup> Systems) |  |  |  |  |
| Category Operational Systems | Budget Activity #4 - Tactical Programs  |  |  |  |  |

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                 | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|---------------------------------------|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities* | 500     | 250     | 2752    | 1164    |                                     |                                     |
| DH58           | EUCOM C <sup>3</sup> Systems          | 500     | 250     | 2752    | 1164    | Continuing                          | Not Applicable                      |
| Procurement:   |                                       |         |         |         |         |                                     |                                     |
|                | Funds                                 | 1200    | 0       | 16000   | 0       | Continuing                          | Not Applicable                      |
|                | Quantities*                           |         |         |         |         |                                     |                                     |

\* Large quantities of various equipments.

BRIEF DESCRIPTION OF ELEMENT: Deputy Secretary of Defense Memorandum, 14 March 1976, directed the Joint Chiefs of Staff (JCS), with the Army as Executive Agent, to examine the entire Command, Control and Communications (C<sup>3</sup>) picture in Europe and to propose options for improvement of overall C<sup>3</sup> systems in Europe. Subsequently, Deputy Secretary of Defense Memorandum, 24 June 1976, directed the Secretary of the Army to plan for

BASIS FOR FY 1978 RDTE REQUEST: Funds are assigned to accomplish research and development work as a result of Deputy Secretary of Defense directed requirements to plan for and recommendations of the European Command, Control and Communications Study.

Budget Activity #4 - Tactical Programs

Program Element #3.31.45.A Title European Command, Control and Communications Systems (EUCOM C3 Systems)

BASIS FOR CHANGE IN FY 1978 OVER FY 1977:

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 3           | 0                  | 3            |
| (2) Contractor Employees   | 40          | 0                  | 40           |
| Total                      | 43          | 0                  | 43           |

DETAILED BACKGROUND AND DESCRIPTION: Deputy Secretary of Defense Memorandum, 14 March 1974, directed the Joint Chiefs of Staff (JCS), with the Army as Executive Agent, to examine the entire Command, Control and Communications (C3) picture in Europe. The study was initiated in April 1974 and a Final Report, identifying deficiencies requiring research, development, and acquisition activities, submitted to JCS in August 1976. The JCS completed their review in February 1976 and submitted their comments to the Secretary of Defense (SECDEF). Since then, the report and its 96 recommendations have served as a baseline for action undertaken to improve the many aspects of European C3.

RELATED ACTIVITIES: US Commander in Chief, Europe, Command and Control Master Plan, which was approved by the Joint Chiefs of Staff as the basis for evolutionary improvements to the US European Command (USEUCOM) command and control system. Deputy Secretary of Defense (DEPSECDEF) Memorandum, 24 June 1976, directed that the Army Plan for

US Army Europe (USAREUR) Command, Control and Information Systems (CCIS) Study. Purpose of the study is to develop a CCIS Master Plan for enhancements between HQ USAREUR, its subordinate commands, other US commands, Allied Command Europe (ACE) commands, and host nation agencies. The US Army Command and Control Master Plan development which will include the formulation of architectural alternatives for theater nuclear level of conflict and integration into the total Army command and control posture.

WORK PERFORMED BY: The European C3 Architecture is a contractual study performed by the International Business Machine, Incorporated (IBM). The Command, Control and Information Systems (CCIS) Group is composed of personnel from subordinate US Army Europe (USAREUR) commands and representatives from Supreme Headquarters Allied Powers Europe (SHAPE), EUCOM, Allied Forces Central Europe (AFCEM), Central Army Group (CENTAG), and Federal Republic of Germany (FRG) agencies under the direction of Deputy Commander,

Budget Activity #4 - Tactical Programs

Program Element #3.31.45.A Title European Command, Control and Communications Systems (EUCOM C3 Systems)

US V Corps. The Department of the Army Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS) has been designated as executive agent for the implementation of the Worldwide Military Command and Control Systems (WMCCS) Selected Architecture. Performance of related tasks will be determined as areas of need are further defined and where emphasis on improvement should be placed.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Funded the initial EUCOM Worldwide Military Command and Control System (WMCCS) Architectural Study. No funds available prior to FY 1976.
2. FY 1977 Program: As a result of the European C3 Study, WMCCS Selected Architecture and the European C3 Implementation Study, specific recommendations were made to improve C3 in Europe. Implementation of certain of these recommendations has begun. Continuing delineation of requirements and capabilities is required in order to establish system deficiencies and formulate solutions to enhance C3 in Europe. Contractual assistance is necessary to finalize US Army Europe (USAREUR) Command, Control and Information System (CCIS) studies; implementation of the USAREUR CCIS Study to include follow-up analysis/study of delineated areas cited in the basic report:

The latter requirement is a combined extension of the European C3 Study and the WMCCS Architecture which will identify specific capabilities, deficiencies and solutions for the 1985 timeframe at this level of conflict.

3. FY 1978 Planned Program:

4. FY 1979 Planned Program: Continued analysis of system deficiencies and formulation of solutions to enhance C3 in Europe. Continuation of communications sharing interoperability, US/NATO follow-up on design of operational/executive control software and hardware to provide SHAPE/USEUCOM joint use of ADF facilities.



Budget Activity #4 - Tactical Programs

Program Element #3.31.45.A

Title European Command, Control and Communications Systems (EUCOM C3 Systems)

5. Program to Completion: The extent and duration of this program is dependent upon the findings and recommendation of the Worldwide Military Command and Control System (WMCCS) Selected Architecture, US Army Command, Control and Information Systems (CCIS) study, European C3 Implementation Plan, and the Army Command and Control Master Plan as approved by Secretary of Defense (SECDEF) and as oriented to improved C3 capabilities in Europe.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.33.01.A Title Advanced Forward Area Air Defense System (AFAADS)  
 Category Advanced Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/ (\$ in Thousands)

| Project Number | Title   | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities                | 3055    | 200     | 24206   | 50836   | 99569                    | 197972               |
|                |   | 0       | 0       | 0       | 8       | 2                        | 10                   |
| D303           | Manportable Air Defense System (MANPADS)            | 2535    | 0       | 0       | 0       | 0                        | 13558                |
| D648           | Low Altitude Forward Area Air Defense Gun (LOFAADS) | 520     | 200     | 24206   | 50836   | 99569                    | 184414               |
| Procurement:   | Funds (LOFAADS)                                     | 0       | 0       | 0       | 0       | 2404700                  | 2404700              |
|                | Quantities (LOFAADS)(Fire Units)                    | 0       | 0       | 0       | 0       | 413                      | 413                  |

1/ Prototypes.

BRIEF DESCRIPTION OF ELEMENT: This program provides necessary development, prototyping and evaluation effort to define and develop new weapons to meet Army requirements for low altitude air defense during the mid-1980 time period.

BASIS FOR FY 1978 RDTE REQUEST: Funds will initiate a U.S. competitive development program for a radar directed, medium caliber (30-40mm) self-propelled gun that will significantly improve the divisional short range air defense capability in the 1980's.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The increase in funding is due to the initiation of a new air defense gun development phase with two contractors developing four prototypes each. Prototypes will be developed from relatively mature weapons subsystems and utilize an existing tank chassis.

Budget Activity #4 - Tactical Programs

Program Element #6.33.01.A

Title Advanced Forward Area Air Defense System (AFAADS)

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |                                    | <u>FY 1977 and Prior</u> | <u>FY 1978</u> | <u>Total</u> |
|----------------------------|-------------|--------------------|--------------|------------------------------------|--------------------------|----------------|--------------|
| (1) Federal Civ. Employees | 79          | 0                  | 79           | (1) Estimated Government Liability | 19720                    | 0              | 19720        |
| (2) Contractor Employees   | 800         | 0                  | 800          | Financed with:                     |                          |                |              |
| Total                      | 879         | 0                  | 879          |                                    |                          |                |              |

TERMINATION COST: (\$ in Thousands)

DETAILED BACKGROUND AND DESCRIPTION:

a. The new Air Defense Gun development program (Project #D648) is the culmination of several years of effort by the Army to define its short range air defense requirements which established the need for a new air defense gun. This requirement was established on 4 August 1976 with the approval of a Required Operational Capability (ROC) document for a new air defense gun in the medium caliber (30-40mm) range which could adequately meet the threat of the 1980's. This gun will give divisional maneuver forces a quick reacting weapon system that can effectively engage pop up targets such as helicopters armed with antitank guided missiles and high speed low flying aircraft at distances of up to 10 km. The system will be mounted on a tank chassis to provide compatible mobility with maneuver forces and will have a full solution fire control system with an optical backup to provide an all environment (i.e., electronic countermeasures and adverse weather) capability. The system will have a rapid changeover capability to provide ground support fires if required and the air situation permits.

b. In FY 1976, the Manportable Air Defense System (MANPADS) (Project #D303) was included under this program element. It was structured to support development of alternate concepts for the STINGER missile system. Further development will be accomplished under P.E. 6.43.06.A, STINGER.

RELATED ACTIVITIES: The Air Defense Gun is related to the CHAPARRAL program (Program Element (P.E.) 2.37.30.A); the VULCAN program (P.E. 2.37.31.A); the Navy's close in Weapons System (PHALANX) (P.E. 6.46.05.N); and the Army's Bushmaster program (P.E. 6.46.17.A). The Army Gun Air Defense System Program Manager is coordinating closely with these other programs to include those items that are already developed into his program.

WORK PERFORMED BY: The program is managed by the US Army Armaments Research and Development Command, Rock Island, Illinois. Two contractors will be chosen for a competitive development program in FY 1978.

Budget Activity #4 - Tactical Programs

Program Element #6.33.01.A

Title Advanced Forward Area Air Defense System (AFAADS)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The Gun Low Altitude Air Defense (GLAAD) test bed was delivered to the Army in September 1975. The purpose of the test bed was to demonstrate through use of off-the-shelf hardware the extent to which current technology could be used in the design of a modern Gun Air Defense System. Testing was concluded in December 1975. The major conclusion of the test was that a second order digital fire control can be integrated with an air defense gun that will provide the capability to credibly engage maneuvering targets.
2. FY 1977 Program:
  - a. The Army plans to issue a Request for Proposal (RFP) for a new Air Defense Gun in early 1977. Based on the responses two contractors would be selected for the development phase. Contract award would occur in early 1978. Planning will be completed for medium caliber proximity fuze testing, a limited comparative evaluation based on existing test data of rocket assisted projectiles to determine potential, and observation of the development/operational tests on production models of the Oerlikon FLAKPANZER system to be conducted by the German Government during 1977.
  - b. Final testing will be completed on the Manportable Air Defense Gun System (MANPADS) seeker (POST SEEKER), and a decision will be made in April 1977 whether to terminate the program or move it into engineering development.
3. FY 1978 Planned Program: Gun prototype hardware fabrication will commence with two contractors building four systems each. The large increase in funding over 1977 is required to purchase hardware immediately for fabrication of prototypes. The development phase requires the delivery of first items to the government in approximately 27 months. Contractors will have to rapidly establish their management staffs and increase their work forces significantly to support the scope of this effort.
4. FY 1979 Planned Program: Prototype fabrication will continue. The funding increase over 1978 results from continuing prototype fabrication effort and the preparation of and initiation of developmental and operational testing.
5. Program to Completion: This 35-month engineering development phase will terminate with the selection of one contractor after a shoot-off to enter an initial production phase. Upon successful completion of this phase a competitive (if feasible) production phase will begin with an estimated first battalion fielding in \_\_\_\_\_. Program completion is estimated for \_\_\_\_\_.

Budget Activity #4 - Tactical Programs

Program Element #6.33.01.A

6. Major Milestones:

Title Advanced Forward Area Air Defense System (AFAADS)

|   | <u>Date</u> | <u>Estimated RDTE Cost to<br/>Reach Events (Cumulative)<br/>(\$ in Millions)</u> |
|---|-------------|--|
| a. Initiate Development Phase               | Oct 1977    | 12.4   |
| b. Complete Prototype Evaluation            | Sep 1980    | 88.9   |
| c. Complete Engineering Development Program | Mar 1982    | 185.5  |
| d. Activate First Gun Battalion             |             | 185.5  |



**Budget Activity #4 - Tactical Programs**

**Program Element #6.33.01.A**

**Title Advanced Forward Area Air Defense System (AFAADS)**

**TEST AND EVALUATION DATA:** The evaluation of the Air Defense Gun will be a coordinated effort between the contractor and Government test and support agencies with a main thrust toward elimination of duplication of test effort and use of simulation and modeling. The end result will be a thorough, yet less costly, analysis of the weapon system prior to the production decision. Prior testing was conducted on the Gun Low Altitude Air Defense System (GLAADS), and completed in December 1975. This was prototype hardware and the results of the test indicated that the concept of a gun system effectively engaging a maneuvering aircraft is valid.

1. **Development Test and Evaluation:** Development Phase: In the Development Phase, two selected weapon systems will be tested to assure that the system specifications have been met and to determine which is the best design. Initially, the contractors will conduct in-house testing at the component and subsystem level, followed by system evaluation by the developer (US Army Armament Research and Development Command, Rock Island, Illinois). Developmental testing is tentatively scheduled to commence at the subsystem level in August 1978. Detailed plans will be developed after contract award in October 1977. The critical issues to be addressed during development testing will be:

- (1) Do the systems meet the probability of hit and system effectiveness requirements?
- (2) Do the systems achieve the target acquisition and target tracking requirements in range and probability requirements in clear and rain environments?
- (3) Do the systems meet response time and ammunition load and reload requirements?
- (4) Do the systems meet Reliability, Availability and Maintainability (RAM) requirements?
- (5) Do the systems meet the survivability, logistics and training requirements?

2. **Operational Test (OT) and Evaluation:** The Operational Test and Evaluation Agency (OTEA) will conduct tests consisting of both a nonfire exercise and an integrated live-fire exercise using military personnel. OT II: Primary objectives of OT II will be to provide data and to conduct an independent evaluation of the operational effectiveness, operational suitability and military utility of prototype air defense guns within as realistic an operational environment as possible prior to Army System Acquisition Review Council (ASARC) III/Defense System Acquisition Review Council (DSARC) III. OT II will also provide information on which to base a production decision. Specific OT II test objectives are shaped by separate critical issues which testing must address. Results of these tests are of primary importance in reaching a decision to continue into initial production. The following critical operational issues will be resolved during the Air Defense Gun test program:

Budget Activity #4 - Tactical Programs

Program Element #6.33.01.A

Title Advanced Forward Area Air Defense System (AFAADS)

- (1) How effectively do the systems accomplish their air defense mission? Can the systems be tactically deployed and fired in a timely manner and is it compatible with other air defense weapons?
- (2) How vulnerable are the systems to visual, aural and IR detection and to what extent do displacement times contribute to the system's vulnerability? How vulnerable are these weapon systems in an EW environment?
- (3) What is the operational reliability, availability and maintainability of the systems and their ancillary equipment?
- (4) Are the prescribed communications adequate for the command and control?
- (5) Is the logistical support adequate for the systems?
- (6) Do the systems possess the same degree of mobility as the unit in which it will be employed?
- (7) Are the current TO&E's and MOS structures adequate to support and operate the systems? Are proposed tactics and doctrine adequate to allow effective employment?

Operational testing is scheduled to begin in January 1980. Detailed test plans will be prepared after contract award in October 1977.

3. System Characteristics:

- a. 30, 35, or 40 MM cannons as main armament.
- b. Radar Acquisition Device capable of detecting a target at \_\_\_\_\_ kilometers.
- c. Radar Tracking Device capable of tracking a target at \_\_\_\_\_ kilometers.
- d. Back-up optical system to be available if acquisition and tracking devices are inoperable.
- e. \_\_\_\_\_ response time from target acquisition until firing first round.
- f. Dual capability - Be able to engage both aerial targets and ground targets.
- g. Mounted on a full track vehicle (M-48 or M-60 tank chassis).
- h. Be able to acquire targets while on the move.
- i. Digital fire control system.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.33.03.A

Title SSM Rocket Systems

Category Component Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                  | FY 1976     | FY 1977     | FY 1978      | FY 1979      | Additional to Completion | Total Estimated Cost |
|----------------|--|-------------|-------------|--------------|--------------|--------------------------|----------------------|
|                | <u>TOTAL FOR PROGRAM ELEMENT</u>       | <u>1000</u> | <u>5000</u> | <u>30113</u> | <u>24000</u> | <u>251107</u>            | <u>311500</u>        |
| D564           | Area Fire Support Rocket System (CSRS) | 1000        | 5000        | 30113        | 24000        | 251107                   | 311500               |

BRIEF DESCRIPTION OF ELEMENT: This effort supports development of the General Support Rocket System which is a multiple rocket launcher system designed to supplement conventional cannon artillery. The mission of the General Support Rocket System is neutralization and/or suppression of enemy indirect fire support and air defense capabilities particularly during surge periods when the rate of targets acquired over-saturates available cannon weapon fire support. A growth potential which permits the attack of point or moving targets is desired.

BASIS FOR FY 1978 RDTE REQUEST: Pending approval by the Army and Defense System Acquisition Review Councils (ASARC/PSARC) Army will initiate two advanced development contracts for competitive prototypes in June of 1977. In FY 1978 these contracts will be continued to system demonstration in FY 1979.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The increase in FY 1978 funding is based on the significantly increased level of effort in the second year of advanced development. In FY 1977 the two competing contractors will initiate development and over a four month period will begin the initial designs and fabricate a limited number of components for the prototypes. In FY 1978 a majority of the initial component fabrication, component tests and subsystem tests are planned. In the later part of FY 1978 some rocket flight tests are to be accomplished.

PERSONNEL IMPACT: The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                           | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|---------------------------|-------------|--------------------|--------------|
| (1) Federal Civ Employees | 74          | 0                  | 74           |
| (2) Contractor Employees  | 287         | 0                  | 287          |
| Total                     | 361         | 0                  | 361          |

**Budget Activity #4 - Tactical Programs**

**Program Element #6.33.03.A**

**Title SSM Rocket Systems**

**DETAILED BACKGROUND AND DESCRIPTION:** The General Support Rocket System is the result of a continuing effort begun in FY 1971. The Institute for Land Combat and the Army Materiel Concept Agency in a study of the 1980-1990 Battlefield recommended that a study be conducted for a Rapid Fire Area Saturation System. The study was completed in early FY 1974 and described two short range unguided multiple rocket launcher systems. In late FY 1974, a preliminary cost effectiveness comparison of General Support Rocket System candidates was conducted by a Training and Doctrine Command Joint Working Group supported by Army Materiel Development and Readiness Command resources. The result of this effort strongly favored a short range, simple to operate, economical multiple launched unguided rocket system. Concurrently, preparation of an Army requirements document was initiated. In the second quarter of FY 1975 the Assistant Secretary of the Army (Research and Development) directed that the Army conduct a complete study of the artillery system. The study report issued in December 1974 included a thorough analysis of the General Support Rocket System and concluded that a relatively small, short range free rocket could perform the counterbattery, air defense suppression mission in a cost effective manner. Based on the results of these studies an agreement was concluded between the Training and Doctrine and Army Materiel Commands in April 1975 which provides for the conduct of activities necessary to complete concept formulation and technology demonstration phases of the General Support Rocket System. The agreement, approved by Department of the Army in September 1975, stated the initial goal as refinement of system characteristics, conduct of tests necessary to reduce risk, and establishment of confidence levels sufficient for commitment to a full scale development based on optimized system parameters, proof of technical feasibility, and investigation of eventual operation doctrine and procedures. The agreement recommended that a Special Study Group (SSG) determine system characteristics. At the direction of DA a Special Study Group was formed in November 1975 and developed a complete concept formulation package. The SSG results were presented to the Defense Systems Acquisition Review Council in January 1977.

**RELATED ACTIVITIES:** There is no development program within the other Services relative to the General Support Rocket System. The Army and the Marine Corps, however, have continuing technology efforts in this area. The Marine Corps has expressed an interest in the Army General Support Rocket System development and has established a group to monitor the Army program development. The Army technology effort has been conducted under program element 1W362303A21410, and is a major Army Missile Research and Development Command thrust area directly supportive to the general area of free (unguided) rockets.

**WORK PERFORMED BY:** In FY 1976 five contracts for concept definition studies were performed by: Boeing Co., Seattle, WA; Emerson Electric, St. Louis, MO; Martin Marietta Corp., Orlando, FL; Northrop Corp., Anaheim, CA; and Vought Corp., Warren, MI. It is anticipated that these five contractors will bid on the two competing Advanced Development contracts in FY 1977.

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

- a. FY 1975 and prior accomplishments: Not Applicable.
- b. FY 1976 and FY 1977 accomplishments: Not Applicable.



**Budget Activity #4 - Tactical Programs**

**Program Element #6.33.03.A**

**Title SSM Rocket Systems**

2. FY 1977 Program: Based on the results of the Special Study Group effort and the program direction given by the Army and Defense Acquisition Review Councils decisions, the concept determined in the best technical approach enters the Advanced Development phase for competitive prototyping in FY 1977. The initial Request for Proposal for development will be released, source selection will take place and the development contracts will be let.

3. FY 1978 Planned Program: FY 1978 will involve full design and development activities for both competitive contractors. Rocket motors, warheads, launchers, launch PODs/containers, fire control systems, and ancillary equipments will be manufactured, subjected to component and subsystem tests, integrated and retested, evaluated and redesigned, and modified to support the initial flight tests in the last quarter of the fiscal year. Systems to be tested in FY 1979 will be started in the manufacturing process. The outline training and document support plans will be initiated. The six (three for each contractor) vehicles will be delivered for integration with the launchers during this period. The increase of funds over FY 1977 results from increased effort which includes fabrication and testing of the majority of the components in FY 1978.

4. FY 1979 Planned Program: Activities during FY 1979 will include: completion of the fabrication of flight test rockets, warheads, and launch PODs/containers; testing of advanced design (low cost) rocket motors; mobility test of the launch vehicles; development test of the rocket system to include tactical warheads by contractor and government; and operational test of the system preparatory to entry into Engineering Development. Approximately 140 rockets will be flight tested under normal conditions with exploratory tests at the environmental extremes and in such areas as ECM, rail humps, vibration and safety.

5. Program to Completion: Development continues with facilitization testing and contract award leading to production and fielding.

**6. Major Milestones:**

|  | Date   | Estimated RDTE Cost to |              |
|--|--------|------------------------|--------------|
|  |        | Reach Events           | (Cumulative) |
| a. Special Study Group Planning                      | Nov 75 | 0                      |              |
| b. Award Concept Definition Contracts                | Feb 76 | \$ 875,000             |              |
| c. Receive and Evaluate Concept Definition Reports   | Jun 76 | \$1,000,000            |              |
| d. Special Study Group Analysis and Report           | Jan 77 | \$1,600,000            |              |
| e. Defense System Acquisition Review Council         | Feb 77 | \$1,625,000            |              |
| f. Release Advanced Development Request for Proposal | Jun 77 | \$2,375,000            |              |
| g. Award Advanced Development Contract               |        |                        |              |





Budget Activity #4 - Tactical Programs

Program Element #6.33.11.A Title PERSHING II Advanced Technology Development

BASIS FOR CHANGE IN FY 78 OVER 77: During FY 78, completion of the fabrication of the prototype reentry vehicles will be accomplished. This, coupled with the activities associated with preparing for and completion of the flight test program, makes FY 78 the peak year of the Advanced Development (AD) program for both the contractor and government.

PERSONNEL IMPACT:

TERMINATION COST: (\$ in thousands)

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |                    | <u>FY 1977 and Prior</u> | <u>FY 1978</u> | <u>Total</u> |
|----------------------------|-------------|--------------------|--------------|--------------------|--------------------------|----------------|--------------|
| (1) Federal Civ. Employees | 54          | 0                  | 54           | (1) Estimated Gov- | 63,300                   | 4,000          | 67,300       |
| (2) Contractor Employees   | 600         | 0                  | 600          | ernment Lia-       |                          |                |              |
|                            |             |                    |              | bility Financed    |                          |                |              |
| Total                      | 654         | 0                  | 654          | with: RDTE         |                          |                |              |

DETAILED BACKGROUND AND DESCRIPTION: The Supreme Allied Commander, Europe, (SACEUR) has expressed a need for a land mobile surface-to-surface missile system that: (1) incorporates high accuracy and immediate responsiveness for the Joint Chiefs of Staff/North Atlantic Treaty Organization (JCS/NATO) Quick Reaction Alert role under all weather-darkness conditions with the most favorable operational factors of survivability and penetrability, (2) fulfills SACEUR's effectiveness requirements against the projected target array to include ongoing Warsaw PACT (PACT) target hardening trends, (3) assists in meeting the of power between NATO and PACT forces by assured destruction of Commander-in-Chief, United States Army, Europe/Supreme Allied Commander, Europe (CINCUSAREUR/SACEUR)'s critical time sensitive targets, any of which are hard targets that policy in reducing anticipated collateral damage by using lower yield warheads and precision accuracy, (5) provides potential for only and for on NATO territory, and (6) employs a guidance system that can be developed with a relatively high level of confidence by using current "state-of-the-art" technology and warheads using advanced nuclear weapon technology. In January 1973 a Special Task Force was formed to validate the need for this missile system and, if validated, to develop a Concept Formulation Package for the system. In October 1973 the Development Concept Paper (DCP) for PERSHING II was presented to and approved by the Army Systems Acquisition Review Council and forwarded to the Defense Systems Acquisition Review Council (DSARC) on 22 January 1974. As a result of a favorable DSARC decision, the Deputy Secretary of Defense, directed the Army to proceed with the Advanced Development of PERSHING II. PERSHING II is a product improvement of the currently fielded PERSHING system using the same propulsion and ground support equipment but incorporating the latest in terminal guidance technology to provide extreme accuracy and permit the use of low yield specialized warheads. PERSHING II will have a range of nautical miles, accuracy in the range of meters Circular Error Probable (CEP) using Radar Area Correlation Terminal Guidance, and the capability to effectively use low yield specialized warheads.

Budget Activity #4 - Tactical Programs

Program Element #6.33.11.A

Title PERSHING II Advanced Technology Development

RELATED ACTIVITIES: Close coordination is maintained with the Air Force on advanced ballistic reentry developments.

Prior year efforts in surface-to-surface missile PERSHING (Program Element 2.21.62.A) and Radar Area Correlation (Project D077) under the Army Materiel Readiness Command have been conducted by the same Project Manager selected to develop this project. These efforts have been closely coordinated with the US Army Missile Research and Development Command (MIRADCOM) funded under Program Element 6.23.03.A, Missile Technology. This is an OSD program and coordination is made by them with all Services.

WORK PERFORMED BY: US Army Missile Research and Development Command, Redstone Arsenal, Alabama; White Sands Missile Range, New Mexico; Martin Marietta, Orlando, Florida; Goodyear Aerospace Corporation, Akron, Ohio; Sanger Company (Kearfott Division), Little Falls, New Jersey; and Bendix Corporation (Navigation and Control Division), Teterboro, New Jersey.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

- a. FY 1977, FY 1976, and Prior Accomplishments: The PERSHING II program started in FY 75. The primary effort during that year was directed toward the design of the reentry vehicle (RV) for the missile flight program in FY 78. The RV underwent minor design changes during FY 75 as a result of the Radar Area Correlation fixed wing flight demonstration program. As a result of competition, US Army Armament Research and Development Command (ARRADCOM), Dover, NJ, was awarded the responsibility of developing the airburst/surface burst warhead section with its associated adaptation kit. The Energy Research and Development Administration was awarded the responsibility of developing the earth penetrator. Design of the RV continued through this period. Preparations were made to support prototype RV fabrication scheduled for FY 77. An engineering model RV was fabricated and limited ground testing on this RV occurred during FY 76 and FY 77.
2. FY 1977 Program: The major prototype components will be delivered during this time period and the fabrication of the prototype RV's will start. System and subsystem tests will occur on these prototypes and preflight certification tests will be conducted in preparation for the six (6) FY 78 missile flights. Advanced engineering of the nuclear warheads will start during FY 77.
3. FY 1978 Planned Program: The six (6) missile flight demonstration program to demonstrate the capability of the Radar Area Correlation Guidance System to attain an accuracy on the order of meters CEP will be accomplished during FY 78. Upon completion of the flight program, the Advanced Development (AD) phase of the PERSHING II program will be completed. The Defense Systems Acquisition Review Council (DSARC II) will meet after completion of the AD phase where the need for PERSHING II will be justified prior to receiving authority to enter Full Scale Development. If DSARC II approves Full Scale Development, projected funding will be required in FY 79.
4. FY 1979 Planned Program: The Engineering Development (ED) phase will be initiated and preparation will be made for Development Test/Operation Test (DT/OT) II & III. Reentry vehicles (RVs) will be fabricated and approximately 70% completed based on the findings of the Advanced Development (AD) effort.

Budget Activity #4 - Tactical Programs

Program Element #6.33.11.A

Title PERSHING II Advanced Technology Development

5. Program to Completion: If DSARC II approves Full Scale Development, the Engineering Development (ED) phase of the PERSHING II program will formally start in FY 79 and culminate in missile flights in During this time, the RV design will be further modified based on the data from the AD phase. This revised design will be followed by intensive system and subsystem tests. Also during the ED phase, required modifications to ground support equipment will be designed and accomplished. Upon completion of this phase, authority will be requested to proceed into production. The Initial Operational Capability should occur in providing troop units in Europe and the Continental United States with a modernized system designed to meet the threat of the

6. Major Milestones:

| Milestones  | Date     | Estimated RDTE Costs to Reach Events (Cumulative) |
|---|----------|---|
| a. Start Development Test/Operation Test (DT/OT) I      | Jan 1978 | \$72.9M   |
| b. Complete DT/OT I                                     | Mar 1978 | \$82.5M   |
| c. Defense System Acquisition Review Council (DSARC) II | Jun 1978 | \$90.0M   |
| d. Award Engineering Contracts                          |          |   |
| e. Start DT/OT II & III                                 |          |   |
| f. DSARC III  |          |   |
| g. Start Low Rate Initial Production                    |          |   |
| h. Complete DT/OT II & III                              |          |   |
| i. DSARC IIIA   |          |   |
| j. Production (Buy 1)                                   |          |   |
| k. Production (Buy 2)                                   |          |   |
| l. Production (Buy 3)                                   |          |   |
| m. Production Deliveries Complete                       |          |   |



Budget Activity #4 - Tactical Programs

Program Element #6.33.11.A

Title PERSHING II Advanced Technology Development

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: As a result of the direction given by the Deputy Secretary of Defense to make no commitment beyond Advanced Development (AD), only AD testing will be addressed. PERSHING II Development Test (DT) I will be conducted by the prime contractor, Martin Marietta Aerospace (except for actual firings, which will be conducted by troops). The objectives of the DT I are to demonstrate: the accuracy characteristics of the new system; the ability of the new guidance system to perform in the missile's flight environment; and the feasibility of using an earth penetrator warhead with the PERSHING II missile. To date, total system evaluations have not been conducted; however, the guidance system has been extensively tested in the laboratory and in helicopter and fixed wing captive flights. These tests have demonstrated the feasibility of the radar area correlation concept. Additionally, evaluations of the new reentry vehicle in simulated flight began in FY 1976. Combining these tests with the fact that PERSHING II is a product improvement of the currently fielded system should provide decision-makers with a wealth of test results upon which to base a decision by the Defense System Acquisition Review Council (DSARC). Reliability, Availability, and Maintainability (RAM) testing will also be accomplished in DT I. Estimated values and confidence limits for RAM levels will be determined for use in supporting management decisions.

2. Operational Test and Evaluation: Operational testing per se will not be conducted during AD. A survivability test will take place during 1977 under the direction of the Project Manager. Although the primary objective of this test is to determine PERSHING's ability to survive on the battlefield, contributions toward improving operational techniques are anticipated. Operational Test and Evaluation Agency (OTEA) will observe all AD testing with a view toward refining operational issues in the event subsequent stages of development are approved for implementation.

3. System Characteristics: Tabular data on selected operational characteristics will be provided after DSARC II. The DT I Flight Test Mission Chart is provided as follows:

| Flight Number          | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------------|---|---|---|---|---|---|
| Range (nmi)            |   |   |   |   |   |   |
| Warhead Configuration  |   |   |   |   |   |   |
| Telemetry with Ballast |   |   |   |   |   |   |

Flight Operations: The objectives of the firing tests are to evaluate the overall missile flight performance and accuracy; the performance of the correlator; the updating functions during the terminal phase; and to provide data on the accuracy of the radar altimeter. An additional objective of the short range firings is to demonstrate that the new airborne guidance system can control a missile during all phases of the flight, thus allowing firings from off-range sites.



Budget Activity #4 - Tactical Programs

Program Element #6.33.11.A

Title PERSHING II Advanced Technology Development

Warhead Tests: Warhead testing to include the adaption kit will involve component qualification, laboratory preflight, environmental, electromagnetic radiation and fire vulnerability, maintainability, and explosive ordnance render safe procedures. Systems compatibility will be verified during flight tests.

Specific Goals in Advanced Development:

|                                    | <u>Goal</u>   | <u>Demonstrated</u> |
|------------------------------------|---|---------------------|
| Inertial Measuring Unit (IMU)      | CEP <u>    </u> without terminal guidance                               | FY 78               |
| Sensor Correlative Subsystem (SCS) | CEP <u>    </u> Meters at range of <u>    </u> NM                       | FY 78               |
| Reentry Vehicle (RV)               | RV will withstand the flight environment<br>(heat, shock and vibration) | FY 78               |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.33.16.A Title Heliborne Missile Guidance Technology  
 Category Advanced Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT    | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost<br>N/A |
|----------------|---------------------------------------|---------|---------|---------|---------|-------------------------------------|-----------------------------|
| D078           | Heliborne Missile Guidance Technology | 0       | 0       | 2094    | 10000   | Continuing                          | N/A                         |

BRIEF DESCRIPTION OF ELEMENT: This element supports advancement of technologies that will provide either a modular "fire and forget" seeker capability for the HELLFIRE Modular Missile System, or an advanced concept such as "laser beam rider" that potentially increases survivability of the Advanced Attack Helicopter (AAH).

BASIS FOR FY 1978 RDTE REQUEST: A concept formulation package consisting of an outline development plan and a procurement package for the advanced seeker will be prepared. Contracts for competitive advanced seeker development will be negotiated.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: FY 1978 submission will initiate competitive advanced development for the advanced seeker requirement for HELLFIRE.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1977 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 17   | 0           | 17    |
| (2) Contractor Employees   | 20   | 0           | 20    |
| Total                      | 37   | 0           | 37    |

DETAILED BACKGROUND AND DESCRIPTION: This project is directed toward developing new missile/seeker concepts to be used on the HELLFIRE Modular Missile System. The purpose of passive seekers is to enhance the survivability of the attack helicopter in a hostile environment while improving its anti-armor capability. The majority of work completed has been by USA Missile Research and Development Command (MIRADCOM) laboratories, within the Missile Technology Programs (6.23.03.A). Several seeker combinations

Budget Activity #4 - Tactical Programs

Program Element #6.33.16.A

Title Hellborne Missile Guidance Technology

and options have been analyzed for developmental potential. Candidates have included primarily the Infrared Imaging Seeker (IRIS) and the Advanced Optical Contrast Seeker (AOCS). The IRIS provides a passive, day/night operational capability. The exploratory development program completed in FY 1976 evaluated two captive flight model seeker concepts. Two contractors were under competitive contract to develop seeker hardware, and delivered in FY 1975 a six inch seeker head capable of surviving missile launch and flight conditions. The AOCS is an extended range daylight only passive television seeker. Competitive exploratory development contracts were awarded to two contractors on 18 March 1974 to design, fabricate, and test prototype seekers. Hardware from both the AOCS and IRIS contracts have been delivered. Congressional action in early 1975 eliminated FY 1976 and FY 1977 funding. Efforts to further develop the IRIS will be predicated on future Air Force development activity in the MAVERICK Infrared (IR) program and non-imaging IR will be assessed as a possible low cost passive seeker option. The ultimate goal within the program is to develop an advanced seeker/missile concept providing the stated advantages for the attack helicopter while minimizing cost/complexity of the expendable missile. Emphasis will be placed on shifting this complexity to the on-board target acquisition system.

RELATED ACTIVITIES: This program is closely related to terminal homing programs of the Air Force and Navy and to two Army Program Elements: 6.23.03.A, Missile Technology and 6.33.10.A, HELLFIRE. Coordination among the services is effected through an Ad Hoc Technical Group, frequent liaison visits and by exchange of components and subsystems for evaluation, and by exchange of program and technical information.

WORK PERFORMED BY: The US Army Missile Research and Development Command (MIRADCOM), Huntsville, AL; US Army Armament Research and Development Command, Dover, NJ; and Harry Diamond Laboratory, Washington, DC. Present major contractors are Hughes Aircraft Company; Texas Instruments, Inc.; and Martin-Marietta Corp.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Work done in the area of missile technology has involved various terminal homing concepts, such as anti-radiation (ARM); IR; radar search; and laser. Exploratory development efforts continued to investigate more advanced imaging and TV seeker concepts. Exploratory development was completed in FY 1975 on the IRIS and AOCS seekers with contracts being awarded, culminating in a limited firing program for the Optical Contrast Seeker (OCS). Additional captive flight testing of the two IRIS seekers and the Navy sponsored non-imaging Night Attack Seeker (NAS) were accomplished under the MIRADCOM laboratory Exploratory Development program.
2. FY 1977 Program: The US Army Missile Research and Development Command (MIRADCOM) laboratories will finish the evaluation of the imaging against the non-imaging seekers this year.
3. FY 1978 Planned Program: Based on the results of the Exploratory Development work in FY 1976 and FY 1977, one or two Advanced Development study contracts will be awarded to industry to determine what seeker type would best accomplish the anti-armor role for HELLFIRE. A concept formulation package consisting of an outline development plan, procurement package for development of the

Budget Activity #4 - Tactical Programs

Program Element #6.33.16.A

Title Heliborne Missile Guidance Technology

advanced seeker, evaluation of proposals for development of the advanced seeker, and development contracts will be completed.

4. FY 1979 Planned Program: Competitive advanced seeker development contracts will continue. Integration and test of the seeker with the missile plus preparatory work for seeker computer simulation test will be initiated and is reflected by increased funding.

5. Program to Completion: Advanced seekers will be delivered and subjected to development and operational test in                      The Advanced Development is scheduled to be completed in early                      and Engineering Development will begin in early                      and                     

..

FY 1978 RYTE DESCRIPTIVE SUMMARY

Program Element #6.33.17.A

Title GRASS BLADE

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                            | FY 1976     | FY 1977     | FY 1978      | FY 1979      | Additional to Completion | Total Estimated Cost |
|----------------|----------------------------------|-------------|-------------|--------------|--------------|--------------------------|----------------------|
|                | <u>TOTAL FOR PROGRAM ELEMENT</u> | <u>4000</u> | <u>9490</u> | <u>13459</u> | <u>11610</u> | <u>0</u>                 | <u>41000</u>         |
| D112           | GRASS BLADE                      | 4000        | 9490        | 13459        | 11610        | 0                        | 41000                |

BRIEF DESCRIPTION OF ELEMENT: Program content is SECRET "Limited Distribution - Special Access Required", precluding further description in this summary. Access to GRASS BLADE information is controlled by the Deputy Chief of Staff for Research, Development and Acquisition.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Adjustment of program scheduling.

RELATED ACTIVITIES: This project is related to work in other Army technology programs.

WORK PERFORMED BY: Both in-house and with contracts.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Details may be provided upon request.



FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.33.18.A

Title Army/Navy Area Surface to Air Missile (SAM) Technology

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project<br>Number | Title<br>TOTAL FOR PROGRAM ELEMENT | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion<br>Continuing | Total<br>Estimated<br>Cost<br>Not Applicable |
|-------------------|------------------------------------|---------|---------|---------|---------|--|--|
| DF33              | Army/Navy Area SAM Technology      | 0       | 0       | 3292    | 4600    | Continuing                                   | Not Applicable                               |

BRIEF DESCRIPTION OF ELEMENT: This program element supports Joint Army/Navy Technology development of common subsystems for use in area defense surface-to-air (SAM) missile systems. Development will be pursued through prototype hardware level of testing to provide a common base for Army and Navy area SAM advancements. Navy program element is 63318N.

BASIS FOR FY 1978 RDT&E REQUEST: Continue the 3-year program initiated in FY 1977 to develop and demonstrate lightweight, low cost prototype phased array antennas using PIN diode phase shifter technology for AEGIS and PATRIOT. Complete the ASAR (Advanced Surface to Air Rocket Ramjet) performance demonstrations of lightweight hardware. Initiate a program for development of a multi-mode seeker with midcourse/terminal guidance capability for existing and second generation Army and Navy area defense missiles. Investigate state-of-the-art technology in several key areas relative to generic deficiencies in current area SAM systems. Areas to be investigated include: bistatic radar/midcourse technology, adaptive signal processors, nondedicated illuminators, and multi-mode guidance.

BASIS FOR INCREASE IN FY 1978 OVER FY 1977: This program was initiated in FY 1977. Expansion of scope of FY 1977 program to include initiation of the development of an autonomous terminal guidance capability for existing and second generation Army and Navy area defense missiles.

Budget Activity #4 - Tactical Programs

Program Element #6.33.18.A

Title Army/Navy Area Surface to Air Missile (SAM) Technology

PERSONNEL IMPACT - FY 1978 MAN YEARS:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                                | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|--------------------------------|-------------|--------------------|--------------|
| (1) Federal Civilian Employees | 13          | 0                  | 13           |
| (2) Contractor Employees       | 45          | 0                  | 45           |
| Total                          | 58          | 0                  | 58           |

DETAILED BACKGROUND AND DESCRIPTION: This program element is structured as a logical step in promoting realistic and achievable commonality. Currently there is considerable coordination in technology programs (6.1 and 6.2). This program provides a logical path into advanced joint development for those technologies which correct common or similar deficiencies in area defense surface to air missiles. It is aimed at promoting translation of technology into common subsystems and basic components. Heavy emphasis is to be placed in this program on prototype hardware demonstration and critical experiments to provide an early assessment of technical risk.

RELATED ACTIVITIES: Missiles/Rocket Components, Program Element 6.33.13.A, Missile Technology, Program Element 6.23.03.A. The NAVY component of this joint effort Program Element 6.33.18.N.

WORK PERFORMED BY: The Applied Physics Laboratory/Johns Hopkins University, Laurel, MD, the Naval Surface Weapons Center, White Oak Laboratory, Silver Spring, MD, and the U.S. Army Missile Research and Development Command, Huntsville, AL, will provide Government support for the program. The Applied Physics Laboratory/Johns Hopkins University, Laurel, MD, Hercules Inc, Cumberland, MD, and Bendix Corp, Wishawaka, IN, will perform the ASAR (Advanced Surface to Air Rocket Ramjet) Program.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976 and Prior Accomplishments: This program element was a new start in FY 1977. In FY 1976 and FY 1977, the PM (Program Memorandum) establishing the Program was drafted and staffed through the Army and Navy chain-of-commands to the DDRE (Department of Defense Research and Engineering) and subsequently approved. Army and Navy personnel also completed preliminary evaluation and planning work relative to the PIN Diode Program and the ASAR Program.
2. FY 1977 Planned Program: Initiate a program through competitive procurement to design, fabricate and test low cost lightweight phased array antennas for AEGIS and for PATRIOT using PIN Diode phase shifter technology. Fabricate ASAR flight-

Budget Activity #4 - Tactical Programs

Program Element #6.33.18.A

Title Army/Navy Area Surface to Air Missile (SAM) Technology

weight engines and conduct ground testing (connected pipe) to simulate both low altitude and high altitude full duration trajectories. Conduct limited qualification testing of the ASAR (Advanced Surface-to-Air Rocket Ramjet) engines. Initiate system investigations of a candidate multi-mode seeker with mid-course terminal guidance in preparation for a FY 1978 new start for development of an autonomous terminal guidance capability for existing and second generation Army and Navy area defense missiles.

3. FY 1978 Planned Program: Continue the 3-year program to develop and demonstrate lightweight, low cost prototype phased array antennas using PIN diode phase shifter technology for AEGIS and PATRIOT. Complete the Advanced Surface to Air Rocket Ramjet (ASAR) performance demonstrations of flightweight hardware. Initiate a program for development of an autonomous terminal guidance capability for existing and second generation Army and Navy area defense missiles. Investigate state-of-the-art in several key areas relative to generic deficiencies in current area SAM systems. Areas to be investigated include: bistatic radar/midcourse technology, adaptive signal processors, nondedicated illuminators, multimode guidance. Direct support for concept definition of alternatives required to counter the Stand-Off Aerial Jammers will also be initiated.

4. FY 1979 Planned Program: Complete fabrication and testing of the prototype PIN diode phase shifter, phased array antennas. Deliver the antenna to the PATRIOT FFG-2 (Frigate Control Group No. 2) site for integration and systems testing to be accomplished under the PATRIOT Program, and deliver the antenna to the AEGIS CSEDS (Combat System Engineering Development Site) for integration and systems testing to be accomplished under the AEGIS Program. Continue the program to develop and demonstrate autonomous terminal guidance for area defense missiles. Initiate one or more new starts based upon the study effort initiated in FY 1978.

5. Program to Completion: The program is planned for a \$6 million effort per year as long as the program has utility.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.33.19.A Title Conventional Airfield Attack Missile (CAAM) Program  
 Category Advanced Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---------------------------|---------|---------|---------|---------|--------------------------|----------------------|
| DH22           | TOTAL FOR PROGRAM ELEMENT | 0       | 0       | 2,968   | 11,000  | 19,000                   | 33,000               |
|                | Quantities                |         |         |         |         | 1/                       | 1/                   |
|                | Funds                     | 0       | 0       | 0       | 0       | 1/                       | 1/                   |

BRIEF DESCRIPTION OF ELEMENT: The CAAM program consists of the conceptual design of a basing concept, runway penetrator submunitions and warhead packaging. This effort will be used as the basis for performing cost and effectiveness analyses of the total system. Tests will be performed to demonstrate the feasibility of the submunition for use against concrete runways and of the warhead packaging and dispensing concept to achieve an acceptable impact pattern. All U.S. and foreign kinetic energy and dual-mode runway penetrators, as well as other munitions concepts, will be considered as candidates for munitions for the CAAM concept. The technology obtained from the program will be applied to candidate delivery systems to establish the best CAAM solution.

BASIS FOR FY 1978 RDTE REQUEST: The technology advancements incorporated into the PERSHING II system offer a potential delivery system with terminal accuracy suitable for immediate, assured, all-weather, conventional attack of PACT main operating airbases. During FY 1978, design, fabrication, and testing of the selected submunition will occur. The selected submunitions (inert) will be packaged into three (3) modified PERSHING II reentry vehicles and dropped from a jet aircraft. The Mojave Test Range will be used for the target area. The reentry vehicle will dispense the selected submunition to demonstrate that the required impact pattern can be generated. If successful, a CAAM system could be fielded in the

BASIS FOR INCREASE IN FY 1978 OVER FY 1977: New start.

1/ Production funds and quantities are not, as yet, defined.

Budget Activity #4 - Tactical Program

Program Element #6.33.19.A

Title Conventional Airfield Attack Missile (CAAM) Program

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE |   | PROCUREMENT |    | TOTAL |   |
|----------------------------|------|---|-------------|----|-------|---|
| (1) Federal Civ. Employees | 10   | 0 | 0           | 10 | 0     | 0 |
| (2) Contractor Employees   | 40   | 0 | 0           | 40 | 0     | 0 |
| Total                      | 50   | 0 | 0           | 50 |       |   |

TERMINATION COST: (\$ in Thousands)

|                                    | FY 1977<br>and<br>Prior | FY 1978 | Total |
|------------------------------------|-------------------------|---------|-------|
| (1) Estimated Government Liability | 0                       | 0       | 0     |
| Financed with: RDTE                |                         |         |       |

DETAILED BACKGROUND AND DESCRIPTION: Of continuing concern to the Defense Department is the problem of:

Our effort to counter the Red advantage has in the past included sheltering of our aircraft, deployment of ground and air defenses and providing a conventional retaliatory capability using manned aircraft. The interdiction of PACT Main Operating Bases (MOBs) to reduce their aircraft sortie rate potential is and virtually unstoppable counter attacks regardless of technology is now available which will permit effective, immediate, Missile (CAAM) is proposed to afford an assured counter strike against the MOBs inoperative while the aircraft are airborne will cause

Rendering the MOBs inoperative while the aircraft are airborne will cause

of shelters or revetments, are unable to support a quick turn around time for follow on sorties, incorporate less capable traffic control systems, and have lower levels of defense than the MOBS. As such, they are

One candidate for the CAAM is a non-nuclear, fixed base version of the PERSHING II fitted with a warhead containing submunitions optimized for the destruction of

counter strike deep into Warsaw Pact territory against airfields in spite of their considerations. There are three (3) objectives of this program: (1) to perform sufficient analyses to make accurate judgments of the most cost effective means of basing, launching, and delivery of a CAAM; (2) to demonstrate that Submunitions can be packaged, delivered, and dispensed by a CAAM; and (3) to design and perform sufficient performance testing of the submunition and fuze to demonstrate feasibility.

A weapon of this type could provide an "immediate"

RELATED ACTIVITIES: The success of the CAAM will depend on the ability to accurately deliver the runway penetrator submunitions to the target. Therefore, close coordination will be maintained by OSD with all Services on the development of all missile systems capable of this accuracy.



Budget Activity #4 - Tactical Program

Program Element #6.33.19.A Title Conventional Airfield Attack Missile (CAAM) Program

WORK PERFORMED BY: U.S. Army Missile Research and Development Command (MIRADCOM), Redstone Arsenal, Alabama; Mojave Test Range, Mojave, California; Martin Marietta Aerospace, Orlando, Florida.

PROGRAM ACCOMPLISHMENTS:

1. FY 1977, FY 1976, and Prior Accomplishments: Not applicable.
2. FY 1977 Program: OSD has directed a study be conducted to determine the feasibility and cost effectiveness of using conventional runway penetrator submunitions delivered by long range missiles for airfield attack. The study will concentrate on existing submunition designs and development programs of both the U.S. and foreign allies to determine their feasibility for the airfield attack mission and their compatibility with candidate missile delivery vehicles. The output of the study will be a conceptual design, cost effectiveness data and a feasibility demonstration forming the basis for a decision to proceed into advanced development.
3. FY 1978 Planned Program: Conceptual design, cost effectiveness analysis and feasibility demonstration will continue in FY 1978. The FY 1978 program will culminate in the airdrop of modified PERSHING reentry vehicles loaded with inert submunitions. Airdrop tests will be made from a jet aircraft over the Mojave Test Range to demonstrate that the required impact pattern can be generated. Data will be made available for use with the various candidate delivery systems.
4. FY 1979 Planned Program: At the completion of the FY 1978 program, a determination will be made on whether or not to proceed into Advanced Development of CAAM. This decision will depend on the ability to demonstrate, during the FY 1978 program, that the CAAM concept is feasible and cost effective in an airfield attack mission. Further, the decision will depend on the availability of a missile system with the required accuracy to deliver the submunitions to the target.

Program to Completion: See paragraph 4.

Major Milestones:

| Milestones  | Date   | Estimated RDTE Costs to Reach Events (Cumulative) |
|---|--------|---|
| a. Complete Submunition Dispensing Tests                              | Jun 78 | 3.7   |
| b. Complete Feasibility and Cost Effectiveness Studies                | Oct 78 | 3.9   |
| c. Complete Development Test (DT) II/III and Operational Test (OT) II |        | 29.0  |
| d. Complete OT III  |        | 33.0  |
| e. Start Production   |        | 33.0  |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.36.12.A Title Advanced Multipurpose Missile System (AMPM)

Category Advanced Development Title #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project<br>Number | Title                                   | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|-------------------|---|---------|---------|---------|---------|--------------------------------|----------------------------|
|                   |   |         |         |         |         |                                |                            |
|                   | TOTAL FOR PROGRAM ELEMENT<br>Quantities | 0       | 0       | 1936    | 22200   | 197764                         | 221900                     |
| D097              | Advanced Multipurpose<br>Missile (AMPM) | 0       | 0       | 1936    | 22200   | 197764                         | 221900                     |

BRIEF DESCRIPTION OF ELEMENT: This program is to develop a multipurpose (antiarmor and self-defense air defense), supersonic, direct fire, missile system. This two-missile configuration provides a shoulder fired medium antiarmor weapon (MAN) and a heavy antiarmor crew served/weapon (HAW) for use by infantry units. The AMPM will be a follow-on system for the DRAGON and TOW antiarmor systems during the mid-1980's.

BASIS FOR FY 1978 RDTE REQUEST: FY 1978 funds will support contracts to industry (responding to a Request for Proposal - RFP) and in-house laboratory efforts (evaluation of contractor proposals, selection of contractors for advanced development competition, monitoring contractor efforts, and continued laboratory technology advancement). The basis for the RFP will be drawn from exploratory and advanced development in related activities and will ask industry for a low-cost solution to a modular, lightweight missile that has an increased range capability, a reduced time-of-flight to maximum range, and a reduced countermeasures susceptibility when compared to currently fielded antiarmor systems.

BASIS FOR INCREASE IN FY 1978 OVER FY 1977: FY 1978 marks the initiation of this project.

Budget Activity #4 - Tactical Programs

Program Element #6.36.12.A

Title Advanced Multipurpose Missile System (AMPM)

PERSONNEL IMPACT:

The average number of employees to be supported with FY 1978 funds (RDTE and Procurement) is as follows:

|                            | <u>RDTE</u> | <u>Procurement</u> | <u>Total</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 13          | 0                  | 13           |
| (2) Contractor Employees   | 62          | 0                  | 62           |
| Total                      | 75          | 0                  | 75           |

DETAILED BACKGROUND AND DESCRIPTION: Several existing guidance technologies have future application to the AMPM. Fire and for-  
get technologies such as optical contrast, infrared imaging, and laser semi-active guidance are being pursued under related  
developmental efforts. Emerging concepts such as millimeter wave and microwave radar, acoustic homing and fiber optics also  
are being considered. Currently, technical assessment reveals that of the applicable technologies for guidance, the supersonic  
beamrider appears to provide the greatest potential. The laser beamrider concept has been proved feasible through flight  
demonstration programs (Stinger Alternate and SHILLELAGH) as an accurate, reliable, and relatively countermeasures hardened  
guidance technique. The Stinger Alternate development program produced the first successful U.S. supersonic laser beamrider  
guided flights in 1975 - 1976 with four successful flights of the ten flown. Also in 1975 - 1976, the SHILLELAGH Laser Beamrider  
flight demonstration program produced fifteen successful flights in fifteen attempts. A combination of the technology base of  
these two programs and the recommendations of the Blue Ribbon Panel for the Evaluation of Laser Beamrider Guidance manifest  
that technology exists to develop a next generation supersonic, direct fire missile.

RELATED ACTIVITIES: Activities considered to be system related are: TOW missile system (Program Element 2.37.24.A), DRAGON  
missile system (Program Element 2.37.27.A), SHILLELAGH missile system (Program Element 2.37.18.A), STINGER Alternate (Program  
Element 6.33.01.A), Advanced Munitions Project (Program Element 6.33.13.A), Small Caliber and Fire Control Technology (Program  
Element 6.26.17.A), and Defense Advanced Research Projects Agency (AFPA) technology investigations and missile technology  
(Program Element 6.23.03.A).

WORK PERFORMED BY: US Army Missile Research and Development Command, Huntsville, Alabama.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments:

Monitored and analyzed results of Defense Advanced Research Projects Agency funded beamrider investigations, STINGER Alternate  
firings and the SHILLELAGH Laser Beamrider Demonstration Program. Prepared to enter concept definition phase. Prepared and  
released Request for Proposal. A one year contract for concept definition, basic guidance hardware, and static tests was awarded  
on June 1976. Began concept definition contract.

Budget Activity #4 - Tactical Programs

Program Element #6.36.12.A

Title Advanced Multipurpose Missile System (AMPM)

2. FY 1977 Program: Complete concept definition phase and prepare to enter Advanced Development. Monitor Defense Advanced Research Projects Agency investigations towards a lightweight laser beam projector. Monitor technology efforts in warhead performance and night vision devices.
3. FY 1978 Planned Program: Conduct Army Systems Acquisition Review Council I/Defense Systems Acquisition Review Council I (ASARC I/DSARC I) proceedings in FY 78 on this new start program and commence advanced development.
4. FY 1979 Planned Program: Continue development of the AMPM. The AMPM will start Developmental Test I (DT I) and Operational Test I (OT I). FY 79 funding increased over FY 78, first year of development, because of normal build up associated with a research and development program.
5. Program to Completion: Complete DT I and OT I and continue development of the AMPM.

6. Major Milestones:

|   | <u>Date</u> | <u>Estimated RDTE Cost to<br/>Reach Events (Cumulative)</u> |
|---|-------------|---|
| a. End conceptual development (ASARC I/DSARC I) and enter<br>advanced development | FY 78       | \$ 1.25M  |
| b. End of Advanced Development (ASARC II/DSARC II)                                | FY 80       | \$58.0M   |

LTC Hinson/A. Brown  
DAMA-WSW-A/70090/TR 94-76

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.36.16.A

Title Tank Gun Cooperative Development

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional 1/ to Completion | Total 1/ Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|-----------------------------|-------------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 540     | 0       | 11232   | 23400   | 74168                       | 110540                  |
| D060           | Tank Gun Cooperative Development     | 540     | 0       | 11232   | 23400   | 74168                       | 110540                  |

1/ Includes tank gun integration. Estimate is dependent on development program selected.

BRIEF DESCRIPTION OF ELEMENT: The program provides for the cooperative test, evaluation and development of improved 120mm gun systems as candidates for a common optimal tank main armament system. Included are improvements to the current NATO standard 105mm gun system.

BASIS FOR FY 1978 RDTE REQUEST: Provides for completion of validation phase and initiation of full scale engineering development (FSED) of the selected 120mm gun configuration with kinetic energy armor piercing fin-stabilized sabot-tracer (APFSDS-T) and counterpart target practice fin-stabilized sabot-tracer (TPFSDS-T) cartridges, continued advanced development of high explosive antitank multiple purpose tracer (HEAT-MP-T) chemical energy and high explosive antitank target practice tracer (HEAT-TP-T) rounds, and initiating advanced development of anti-personnel (APERS) and smoke cartridges.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Procurement of additional cannon and ammunition hardware to validate readiness of gun with kinetic energy, chemical energy and associated practice rounds to enter FSED, procurement of validation quantities of screening and smoke rounds, and to investigate unique system factors such as high ballistic firing pressures and use of German designed cartridge cases with non-metallic (combustible) sidewall.



Budget Activity #4 - Tactical Programs

Program Element #6.36.16.A Title Tank Gun Cooperative Development

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 75          | 0                  | 75           |
| (2) Contractor Employees   | 175         | 0                  | 175          |
| Total                      | 250         | 0                  | 250          |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to provide the best main armament system for the XM1 tank to counter the long-term armor threat. This program is an outgrowth of the 1975 Tripartite (United States, United Kingdom and Federal Republic of Germany - US, UK and FRG) Tank Main Armament Evaluation, a continuing analysis of future armor threats and recognition of NATO harmonization/standardization efforts.

RELATED ACTIVITIES: This program is related to Program Element (PE) 6.46.20.A, Tank XM1, PE 6.36.08.A, Weapons and Ammunition and dependent upon technology developed under PE 6.26.18.A, Ballistics Technology and 6.26.03.A, Large Caliber Systems Technology. Previous funding was provided under PE 6.36.08.A, Weapons and Ammunition.

WORK PERFORMED BY: US Army Armament Research and Development Command, Dover, NJ; and the US Army Test and Evaluation Command, Aberdeen, MD.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: A comprehensive Tripartite (US, UK and FRG) Tank Main Armament Evaluation was conducted in FY 1975 to determine the performance of each country's candidate system against a wide spectrum of armor arrays and evaluate the combat effectiveness of each against the known and postulated enemy armor threat. The evaluation included testing of additional developmental items to identify the growth potential of the competing systems. The evaluation demonstrated the capability of the US 105mm system with improved ammunition to counter near and mid-term threats, concluded that of the three calibers tested the 120mm provided the best basis for future development of advanced tank weapon systems, and recommended that an optimal main armament system, considering both smooth and rifled bore designs, but based initially on the FRG 120mm system be developed. Impetus was added to the selection and development of the optimal 120mm gun as a result of the July 1976 addendum to the December 1974 United States/Federal Republic of Germany Memorandum of Understanding concerning XM1/LEOPARD 2 harmonization.

2. FY 1977 Program: Limited 120mm comparative trials will be completed in FY 77 and a 120mm gun system selected for future incorporation in the XM1 Tank System. Translation and adaptation of design information for the selected system to achieve

Budget Activity #4 - Tactical Programs

Program Element #6.36.16.A

Title Tank Gun Cooperative Development

compatibility with US production base facilities and industrial equipment will start. Requirements documents for the gun and its total ammunition complement including training rounds will be finalized. Fuzing design of the chemical energy round will be reviewed for safety. Remaining validation necessary to confirm readiness for full scale development of the gun with its kinetic energy, chemical energy, and counterpart training ammunition will be finalized. Conceptual development of anti-personnel and smoke rounds will start.

3. FY 1978 Planned Program:<sup>3/</sup>Using hardware procured from the foreign developer, validation testing of the 120mm gun and armor piercing fin-stabilized discarding sabot-tracer (APFSDS-T), high explosive antitank multiple purpose tracer (HEAT-MP-T) and training rounds through Development Test/Operational Test (DT/OT) I will be completed. The required operational capability (ROC) will be established as will the interface constraints with the XM1 tank system and the coordinated test program for the 120mm gun. Development contracts to US producers for armor piercing fin-stabilized discarding sabot-tracer (APFSDS-T) and target practice fin-stabilized discarding sabot-tracer (TPFSDS-T) rounds and cartridge cases will be awarded and in-house fabrication of development quantities of cannon and energetic compounds initiated. The validation phase of development for anti-personnel (APERS) and smoke rounds will be started. Evaluation of unique aspects of a 120mm gun such as high ballistic firing pressures and the use of cartridge cases with a non-metallic sidewall will be conducted. Funding increase over FY 1977 reflects necessary requirements to implement a development program on the selected 120mm gun configuration and ammunition.
4. FY 1979 Planned Program:<sup>3/</sup>Complete fabrication by US producers of cannon, APFSDS-T and TPFSDS-T rounds necessary for DT II/OT II and start DT II/OT II testing of these items. Award engineering development contracts for high explosive antitank target practice tracer (HEAT-TP-T) rounds. Complete DT I/OT I for APERS and smoke rounds and award engineering development contracts for those rounds. Funding increase over FY 1978 reflects cost of US fabrication of gun and ammunition family and conduct of development and operational testing.
5. Program to Completion:<sup>3/</sup>Engineering development testing (DT II/OT II) of the 120mm gun with the APFSDS-T and TPFSDS-T rounds will be completed and the system type classified in FY 80. Fabrication of hardware quantities for DT II/OT II of the chemical energy high explosive antitank multiple purpose tracer (HEAT-MP-T), associated target practice HEAT-TP-T, anti-personnel (APERS) and smoke rounds will be completed and DT II/OT II of these items will start during FY 80; DT II/OT II will be completed and these items type classified in FY 81.

Budget Activity 4 - Tactical Programs

Program Element #6.36.16.A

Title Tank Gun Cooperative Development

6. Major Milestones:

|  | Date   | Estimated RDTE Cost to 1/<br>Reach Events (Cumulative) |
|--|--------|--|
| a. Evaluation of candidate 120mm gun systems                           | 1QFY77 | 1200   |
| b. Selection of 120mm gun configuration                                | 2QFY77 | 2800   |
| c. Confirm requirements documents for gun and ammo complement          | 2QFY77 | 2800   |
| d. Start validation phase of gun, APFSDS-T & TPFSDS-T 2/               | 2QFY77 | 2800   |
| e. Start validation of HEAT-MP-T & HEAT-TP-T 2/                        | 3QFY77 | 4400   |
| f. Start Development Test/Operational Test (DT/OT) I of gun & APFSDS-T | 1QFY78 | 9400   |
| g. Complete DT I/OT I of gun & APFSDS-T                                | 2QFY78 | 12900  |
| h. Complete conceptual phase of APERS & Smoke (IPR I) 2/               | 2QFY78 | 12900  |
| i. Start engineering development of gun & APFSDS-T                     | 3QFY78 | 16400  |
| j. Complete DT I/OT I of HEAT-MP-T                                     | 4QFY78 | 19900  |
| k. Start DT II/OT II of gun & APFSDS-T                                 | 3QFY79 | 34500  |
| l. Complete DT I/OT I of APERS & Smoke                                 | 3QFY79 | 34500  |
| m. Complete DT II/OT II of gun & APFSDS-T                              | 2QFY80 | 47600  |
| n. Type classify gun & APFSDS-T  | 3QFY80 | 51700  |
| o. Complete DT II/OT II of HEAT-MP-T, HEAT-TP-T & TPFSDS-T             | 1QFY81 | 57200  |
| p. Type classify HEAT-MP-T, HEAT-TP-T & TPFSDS-T                       | 2QFY81 | 58700  |
| q. Complete DT II/OT II of APERS & Smoke                               | 3QFY81 | 60200  |
| r. Type classify APERS & Smoke   | 4QFY81 | 61600  |

1/ Does not include tank gun integration.

2/ Armor Piercing Fin Stabilized Discarding Sabot Tracer (APFSDS-T); Target Practice Fin Stabilized Discarding Sabot Tracer (TPFSDS-T); High Explosive Anti-Tank Multiple Purpose Tracer (HEAT-MP-T); High Explosive Anti-Tank Target Practice Tracer (HEAT-TP-T); Anti-Personnel (APERS); In Process Review (IPR).

3/ This program will be revised as a result of January 1977 negotiations with FRG (Federal Republic of Germany).

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.36.25.A

Title Armored Cavalry Vehicle (ACV)

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES [PROJECT LISTING]: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977  | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--------------------------------------|---------|----------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 1,541   | 3,970 1/ | 174     | 2,081   | 7,328                    | 15,395 2/6           |
| DH65           | Armored Cavalry Vehicle              | 1,541   | 3,970    | 174     | 2,081   | 7,328                    | 15,395               |

BRIEF DESCRIPTION OF ELEMENT: This program is designed to establish the requirements for the Mechanized Infantry Combat Vehicle (MICV)/SCOUT, and develop the required system with the TOM/BUSHMASTER Armored Turret II (TBAT II) generated in the MICV development program.

BASIS FOR FY 1978 RDTE REQUEST: This funding will be used to finalize the system specifications, based on the user requirements and MICV development activity, preparatory to contract negotiation.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Decrease in funding is due to reduced hardware effort in this period, with primary effort concentrated on establishment of the system specification.

PERSONNEL IMPACT: The average number of employees supported with requested FY 1978 funds (RDTE and Procurement) is as follows:

|                           | RDTE | PROCUREMENT | TOTAL |
|---------------------------|------|-------------|-------|
| (1) Federal Civ Employees | 7    | 0           | 7     |
| (2) Contractor Employees  | 0    | 0           | 0     |
| Total                     | 7    | 0           | 7     |

1/ Includes \$3,170 thousand required for TBAT II development effort to be completed in the MICV, XM723 program.

2/ Includes \$412 thousand of FY75 program under Program Element 6.46.18.A, Armored Reconnaissance Scout Vehicle, XM800 utilized as partial funding of the MICV/SCOUT Test Bed.



Budget Activity #4 - Tactical Programs

Program Element #6.36.25.A

Title Armored Cavalry Vehicle (ACV)

DETAILED BACKGROUND AND DESCRIPTION: This program will determine the feasibility and suitability of using a version of the Mechanized Infantry Combat Vehicle (MICV) as the Army's scout vehicle and will support initiation of the TOW/BUSHMASTER Armored Turret II (TBAT II) development effort. A MICV chassis, modified for use of the two-man weapon station will be used. This vehicle will be delivered in FY 1977 to support TBAT II development. Evaluation of the MICV will consist of examination of cross-country performance and ability to perform the role of the Armored Cavalry Vehicle (ACV). TBAT II, developed in the MICV program will be integrated to this effort to develop the ACV configuration. The TBAT II will be a two-man weapon station incorporating the BUSHMASTER cannon, the TOW missile systems under armor, and a coaxial machine gun with an integrated sight for use of all weapon station mounted weapons.

RELATED ACTIVITIES: Program Element 6.46.26.A, Improved TOW Vehicle (ITV); Program Element 6.46.16.A, Mechanized Infantry Combat Vehicle (MICV), XM723, and Program Element 6.46.17.A, Vehicle Rapid Fire Weapon System (VRFWS) BUSHMASTER, support the ACV chassis and 25mm automatic weapon and ammunition respectively.

WORK PERFORMED BY: In-house effort is being accomplished by US Army Tank Automotive Research and Development Command, Warren, MI; with other government installation support by US Army Electronics Research and Development Command, US Army Missile Research and Development Command. The major contractor is FMC Corporation, San Jose CA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, 1976 and Prior Accomplishments: Fabrication of the test bed was initiated. Vehicle interior was mocked-up and used to establish internal configuration. Fabrication of the test bed was continued into FY 1977.
2. FY 1977 Program: Test bed will be completed and development of TBAT II will be initiated.
3. FY 1978 Program: Requirement for ACV will be established and System Specification will be developed for contract negotiation.
4. FY 1979 Planned Program: Contract will be awarded for development of ACV system.
5. Program to Completion: Five vehicle systems will be produced for evaluation in Prototype Qualification Test Government (PQT-G)/Operational Test II (OT II) testing.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.36.27.A

Title Combat Support Munitions

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT<br>Quantities | FY 1976<br>2260 | FY 1977<br>1010 | FY 1977<br>1863 | FY 1978<br>2374 | FY 1979<br>2247 | Additional<br>to<br>Completion<br>Continuing | Total<br>Estimated<br>Cost<br>Not Applicable<br>Not Applicable |
|----------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|--|--|
| DE71           | Weapons and Ammunition                           | 0               | 0               | 0               | 0               | 0               | Continuing                                   | Not Applicable   |
| DE82           | Flame, Smoke, and<br>Incendiary Material         | 2260            | 1010            | 1863            | 2374            | 2247            | Continuing                                   | Not Applicable   |

BRIEF DESCRIPTION OF ELEMENT: This program supports studies, investigations, evaluations and advanced development of promising new and improved flame, incendiary and smoke equipment and weapon systems. Riot control agents, munitions, devices and equipment for both tactical use and controlling civil disturbances are also developed under this program.

BASIS FOR FY 1978 RDTE REQUEST: Efforts will include continued evaluation of rapid smoke systems for protection of armored vehicles, and advanced development (AD) on promising new flame, incendiary and especially smoke weapon systems with primary emphasis on artillery and mortar projectiles. AD will also commence on a riot control agent convoy protective system, a rescue system and a protective system for internal security.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The increase in funds is needed to support the following: AD efforts on high priority smoke systems for the protection of armored vehicles; new and improved munitions for screening, obscuration, signalling and marking; and riot control agent protective systems.

Budget Activity #4 - Tactical Programs

Program Element #6.36.27.A Title Combat Support Munitions

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 18   | 0           | 18    |
| (2) Contractor Employees   | 22   | 0           | 22    |
| Total                      | 40   | 0           | 40    |

**DETAILED BACKGROUND AND DESCRIPTION:** The objective of this program is to conduct advanced development of promising new and improved flame, incendiary and smoke weapon systems with primary emphasis on artillery and mortar projectiles and on improved smoke protective systems for all armored vehicles. Advanced development (AD) is also provided for riot control agent and munitions, devices and equipment for both tactical use and controlling civil disturbances. These projects were originally part of Program Element 6.36.08.A, Weapons and Ammunition.

**RELATED ACTIVITIES:** Development under this project is supported by research being conducted under Program Element 6.26.22.A, Chemical Munitions and Chemical Combat Support. Coordination is maintained with other Services to preclude duplication of effort. This program supports engineering development under Program Element 6.46.09, Combat Support Systems. Coordination and cooperation is maintained with the United Kingdom, Canada, and the Federal Republic of Germany.

**WORK PERFORMED BY:** In-house work by US Army Armament Research and Development Command (ARRADCOM), Edgewood, MD; Dugway Proving Ground, UT; ARRADCOM, Dover, NJ; and Watervliet, NY; and Harry Diamond Laboratories, MD. Contractors are Buck KG, Germany, and others to be determined.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1976, FY 1977, and Prior Accomplishments: Under Program Element 6.26.22.A, Chemical Munitions and Chemical Combat Support a concept of improved screening materials and munitions was developed and demonstrated in August 1975. Work was done at ARRADCOM, Edgewood, MD on the use of wicks imbedded in white phosphorous (WP) to improve the burning characteristics and smoke generating capability of 155 WP WICK projectiles. Because of instability problems the program was reoriented to a competitive advanced development program between red phosphorus (RP) and WP. In FY 1977, a contract was awarded to Buck, KG, Germany, to fill 81mm mortar shells with a red phosphorus mixture.

Budget Activity #4 - Tactical Programs

Program Element #6.36.27.A

Title Combat Support Munitions

2. FY 1977 Program: Development of a 81mm mortar smoke round will be initiated. An Outline Development Plan will be prepared. Design analysis will be conducted to select approaches for components/systems prototypes to be experimentally tested. Competitive development of red phosphorous (RP) and white phosphorous (WP) submunitions will be initiated. The competitive 155mm WP and RP program will be conducted. The best design will be selected for competition during a Development Test I/Operational Test I (DT I/OT I). Complete AD of a shaped charge incendiary round.
3. FY 1978 Planned Program: The development of component/systems hardware for the improved 81mm mortar smoke round will continue. The design approach will be validated through safety, rough handling, firing tests, and the conduct of a Development Test I/Operational Test I (DT I/OT I) test sequence. Best designs for the 155mm WP and RP projectile will be selected and DT I/OT I will be conducted after which a Validation In-Process Review held. Optimized Infrared (IR) Defeating Smoke Grenade System development will be initiated. Advanced Development prototypes will be fabricated incorporating improved agents to meet user requirements. Design studies will be initiated to select the best munitions concepts for a 105mm improved smoke projectile. Prototype development of the 105mm projectile will be initiated for early development testing. The increased funds are needed to support high priority new/improved mortar and artillery smoke munitions.
4. FY 1979 Planned Program: The fabrication of items for and conduct of Development Test/Operational Test (DT I/OT I) for the 105mm projectile, and the infrared (IR) defeating grenade system will be accomplished. Advanced development will be initiated on a Large Area Smoke Screening System. The decrease in funds are due to the expected completion of advanced development of an 81mm mortar round and a 155mm improved smoke projectile.
5. Program to Completion: This is a continuing program.

MAJ Zimmerman/A. Brown  
DAMA-CSM/57668/TR 219-76

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.36.28.A

Title Field Artillery Weapons and Ammunition Development

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/ (\$ in Thousands)

| Project Number | Title                                  | FY 1976     | FY 1977     | FY 1978     | FY 1979      | Additional to Completion Continuing | Total Estimated Cost | Not Applicable |
|----------------|--|-------------|-------------|-------------|--------------|-------------------------------------|----------------------|----------------|
|                | <u>TOTAL FOR PROGRAM ELEMENT</u>       | <u>4018</u> | <u>3746</u> | <u>9679</u> | <u>13657</u> |                                     |                      |                |
| D007           | Field Artillery Ammunition Development | 3348        | 60          | 5731        | 8126         | Continuing                          | Not Applicable       |                |
| D008           | Field Artillery Weapons Development    | 670         | 150         | 1867        | 1600         | Continuing                          | Not Applicable       |                |
| D276           | Improved Conventional Munition         | 0           | 0           | 2081        | 3931         | Continuing                          | Not Applicable       |                |

BRIEF DESCRIPTION OF ELEMENT: This program supports design and development of more reliable and effective cannon weapons and ammunition.

BASIS FOR FY 1978 RDTE REQUEST: To provide for: continued advanced development of an 8-inch high explosive projectile, development of inexpensive indirect fire mortar and artillery training projectiles, development of an 8-inch extended range projectile, and to provide for continued alternate explosive fill testing. Development of a large caliber soft recoil test fixture, towed and self-propelled, will continue. Advanced development of artillery random delay submunitions and artillery delivered multi-purpose submunitions will be initiated.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Initiation of advanced development of an 8-inch extended range ammunition, the random delay sub-munition, the multi-purpose submunition, and the howitzer range extension program.

Budget Activity #4 - Tactical Programs

Program Element #6.36.28.A Title Field Artillery Weapons and Ammunition Development

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 62          | 0                  | 62           |
| (2) Contractor Employees   | 30          | 0                  | 30           |
| Total                      | 92          | 0                  | 92           |

DETAILED BACKGROUND AND DESCRIPTION: The program consists of three projects which include work in field artillery weapons and ammunition development. Field artillery weapon development will focus on a large caliber, armored self-propelled howitzer to replace current systems. Artillery ammunition projects include an 8-inch HE projectile, as well as 8-inch extended range projectiles. Inexpensive artillery and mortar training projectiles, to provide significant annual savings in training munitions costs, will continue in advanced development. The random delay submunition will provide significantly increased effectiveness, and will provide a suppressive fire capability against enemy artillery. The multi-purpose submunition is being developed for use in either artillery projectiles or missiles.

RELATED ACTIVITIES: The projects in this program are related to program elements 6.26.03.A Large Caliber & Nuclear Technology (AH18), where exploratory work is performed, and 6.46.27, Field Artillery Weapons and Ammunition, 8-inch, where engineering development is conducted. Advanced development of the XM711 8-inch high explosive projectile is related to the XM650 rocket assisted projectile and the XM753 nuclear projectile. Developments in this program element are compatible with US Marine Corps requirements and are closely coordinated through joint meetings to preclude duplication of effort.

WORK PERFORMED BY: US Army Armament Research & Development Command (ARRADCOM) Dover, New Jersey, ARRADCOM, Edgewood, Maryland; Army Materiel Systems Analysis Agency, Aberdeen, Maryland; ARRADCOM, Aberdeen, Maryland; and ARRADCOM, Watervliet, New York. Contractors performing work in this program element are the Chamberlain Corporation, Waterloo, Iowa; Space Research Corporation, Troy, Vermont.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: Efforts were undertaken to qualify for mobilization purposes, alternate explosive fills in shells, bomblets, and shaped charge warheads. The objective was to reduce the capital costs associated with modernizing and expanding the production base. Surveillance testing of climatically conditioned munitions to establish storage characteristics was initiated. The qualification of alternate explosive fills in artillery shells was completed and manufacturing processes



Budget Activity #4 - Tactical Programs

| Program Element | Title  |
|-----------------|--|
| #6.36.28.A      | Field Artillery Weapons and Ammunition Development |

refined. The XM711 8-inch projectile advanced development program continued while the XM762 competitive program was terminated as a result of Congressional action. A test fixture to demonstrate the soft recoil concept to large caliber artillery was fabricated.

2. FY 1977 Program: Surveillance testing of munitions, previously filled with alternate explosive fills, will continue. Preliminary range match tests and flight stability tests of the XM711 will be conducted. Advanced development of an 81mm mortar concrete filled plastic training projectile and an inert 155mm training projectile will be initiated. The range extension program to demonstrate compatibility between the M109A1 self-propelled howitzer and XM203E2, zone 8 propelling charge will continue. A special study group to evaluate the best technical and tactical considerations of future armored, self-propelled howitzers will be initiated.

3. FY 1978 Planned Program: Surveillance, climatic conditioning, and testing of alternate explosive fills will continue. Fracture mechanics, fragmentation tests, range match tests and gun tube wear tests of the XM711 8-inch projectile will be conducted. Funding increase is to provide for the 60mm mortar and 105mm and 8-inch artillery training projectiles development using the technology derived from the FY 1977 program. Increased funds required to initiate development of a new 8-inch extended range projectile to provide an increased range capability, and random delay submunitions and multi-purpose submunitions which will provide significantly increased lethal effects. Compatibility testing for M109/M203 will continue and Development Test/Operational Test (DT/OT) hardware will be manufactured.

4. FY 1979 Planned Program: Alternate explosive fills testing will continue. The XM711 is scheduled to transition to engineering development (6.46.27) Field Artillery Weapon's & Ammo during the 4th Quarter. Two new projects will be initiated which require increased funding: development of a consolidated charge and implementation of an artillery hardware optimization program. The large caliber soft recoil technology will be applied to a self-propelled vehicle.

5. Program to Completion: This is a continuing program.

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.36.28.A

Title Field Artillery Weapons and Ammunition Development

Project #D007

Title Field Artillery Ammunition Development

Category Advanced Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: This project comprises four independent areas of effort to bridge the gap between applied research, and engineering development of the end item: 8-inch high explosive projectile; alternate explosive fills for projectiles; inexpensive artillery and mortar training projectiles and 8-inch extended range projectiles. The objective of the 8-inch high explosive projectile (XM711) effort is to conduct an advanced development program to determine a replacement for the current M106 projectile and extend the range of 8-inch howitzers. The explosive fill program objectives are to evaluate alternate compositions for use during mobilization and conserve high performance explosive components with limited availability. The training projectile effort will develop inexpensive projectiles to replace current high explosive projectiles in training requirements which will generate significant annual savings. The 8-inch extended range ammunition program will develop candidate projectiles for use in existing howitzers to provide an increased range capability.

RELATED ACTIVITIES: Development of the 8-inch projectile XM711 is related to developments of other 8-inch projectiles such as the XM650 rocket assisted projectile (6.46.27 D666) Field Artillery Weapons & Ammo, 8 inch (Ammo, Cannon, 8-inch) and the 8-inch nuclear projectile (6.46.03 D663) Nuclear Munitions, (Improved 8 in Nuclear Project).

WORK PERFORMED BY: Primary responsibility for these programs resides in the US Army Armament Research & Development Command (ARRADCOM) Dover, New Jersey. It is supported by: ARRADCOM Aberdeen, Maryland; Yuma Proving Ground, Yuma, Arizona; Army Materiel and Mechanics Research Center, Watertown, Massachusetts; ARRADCOM Edgewood, Maryland, ARRADCOM Watervliet, New York. Probable contractors are Space Research Corporation, Troy, Vermont; Chamberlain Corporation, Waterloo, Iowa; and Norris Industries, Vernon, California.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Efforts were undertaken to qualify for mobilization purposes alternate explosive fills in shells, bomblets, and shaped charge warheads. The objective was to reduce the capital costs associated with modernizing and expanding the production base by reducing the difficult to manufacture and expensive explosive components. Results of Alternate Explosive Fills Program presented to DOD for approval and implementation. Qualification of alternate fills was basically completed for artillery shells. Surveillance testing of climatically conditioned munitions, previously filled with alternate explosives continued, to establish long-term storage characteristics. The XM711 advanced development program continued while the XM762 competitive program was terminated as the result of Congressional action.

Budget Activity #4 - Tactical Programs

Program Element #6.36.23.A

Title Field Artillery Weapons and Ammunition Development

Project #D007

Title Field Artillery Ammunition Development

2. FY 1977 Program: Surveillance testing of munitions, previously filled with alternate explosive fills, will continue. Preliminary range match tests and flight stability tests of the XM711 will be conducted. Advanced development of an 81mm mortar concrete filled plastic training projectile and an inert 155mm training projectile will be initiated.
3. FY 1978 Planned Program: Surveillance, climatic conditioning, and testing of alternate explosive fills will continue. Fracture mechanics, fragmentation tests, range match tests, and gun tube wear tests of XM711, 8-inch projectile will be conducted. Increased funding is required to develop a 60mm mortar training projectile as well as 105mm and 8-inch artillery training projectiles. Advanced development to include transonic range and flight tests will be initiated for the 8-inch extended range projectile.
4. FY 1979 Planned Program: Surveillance testing of alternate explosive fills will continue. The XM711 will continue advanced development and transition to engineering development during the 4th Quarter FY 1979. Two new projects will be initiated requiring increased funding; development of a consolidated charge, and implementation of an artillery hardware optimization program to improve the areas of internal ballistics, rotating band design, ignition train modelling, and interface optimization.
5. Program to Completion: Long-term testing of alternate explosive fills will continue. This is a continuing program.

RESOURCES: (\$ in Thousands)

|             | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional to Completion</u> | <u>Total Estimated Cost</u> | <u>Not Applicable</u> |
|-------------|----------------|----------------|----------------|----------------|----------------|---------------------------------|-----------------------------|-----------------------|
| RDTE: Funds | 3348           | 60             | 3209           | 5731           | 8126           |                                 |                             |                       |

FY 1978 RDT&E DESCRIPTIVE SUMMARY

|                 |                      |                 |  |
|-----------------|----------------------|-----------------|--|
| Program Element | #6.36.28.A           | Title           | Field Artillery Weapons and Ammunition Development |
| Project         | #D276                | Title           | Improved Conventional Munitions                    |
| Category        | Advanced Development | Budget Activity | #4 - Tactical Programs                             |

DETAILED BACKGROUND AND DESCRIPTION: This project comprises three independent areas of effort: artillery delivered random time delay submunition, artillery delivered multi-purpose submunitions, and beginning in FY 1979, the selected armor defeating artillery munition. The objective of the project is to develop selected munitions having significantly increased effectiveness against personnel and materiel targets, resulting from the use of individually fuzed submunitions optimized for specific classes of targets. First generation improved conventional munitions (ICM) have been produced and placed in the stockpile. The armor defeating munition will provide additional antitank capability.

RELATED ACTIVITIES: The tasks in this project are related to exploratory development efforts being conducted in program element 6.26.03.A, Large Caliber & Nuclear Technology. Engineering development will be continued on these tasks in program element 6.46.05, D369, Field Artillery Ammunition, 105mm (Improved Conventional Ammunition).

WORK PERFORMED BY: Primary responsibility for these programs resides with Project Manager for Selected Ammunition, US Army Armament Research & Development Command (ARRADCOM), Dover, New Jersey. It is supported by: ARRADCOM Aberdeen, Maryland; Army Materiel and Mechanics Research Center, Watertown, Massachusetts; ARRADCOM, Watervliet, New York; and Yuma Proving Ground, Yuma, Arizona. Probable contractor is Chamberlain Corporation, Waterloo, Iowa.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: There was no funding provided in FY 1975, FY 1976, or FY 1977. Prior accomplishments include the successful completion of advanced development of the small cylindrical antipersonnel submunition (ROCK) which is now in engineering development as a component to the XM710, 105mm projectile.
2. FY 1977 Program: Exploratory development effort will continue at ARRADCOM, Dover, New Jersey.
3. FY 1978 Planned Program: The random delay submunition task and the multi-purpose submunition task will be initiated in FY 1978, requiring increased funding.. Advanced development will include initial production and testing of prototype submunitions, investigation of fuzing concepts, and in conjunction with US Army Training and Doctrine Command (TRADOC) development of methodology to adequately assess the effectiveness of suppressive fire.
4. FY 1979 Planned Program: Advanced development of the submunition tasks will continue. Selected cannon and missile test vehicles will be utilized for initial dynamic system tests. A determination will be made as to the weapon caliber(s) selected for

Subject Activity #4 - Tactical Programs

Program Element #6.36.28.A

Project #9276

Title Field Artillery Weapons and Ammunition Development

Title Improved Conventional Munitions

engineering development. The selected armor defeat mechanism munition will begin advanced development, requiring increased funds. This mechanism provides for a long standoff, influence fuzed device designed to defeat armor in the indirect fire mode.

3. Program to Completion: This is a continuing program.

6. Major Milestones:

a. Completion of advanced development of random time delay submunition.

b. Completion of advanced development of multi-purpose submunition.

RESOURCES: (\$ in Thousands)

Estimated RDTE Cost to Reach Events (Cumulative)

Date

FY 1979

FY 1980

\$3148 (K)

\$2996 (K)

Additional to Completion  
Total Estimated Cost  
Continuing Not Applicable

FY 1979

FY 1978

FY 1977

FY 1976

FY 1975

3931

2081

0

0

0

RDTE: Funds



# FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.04.A

Title Unattended Ground Sensors (UGS)

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title   | TOTAL FOR PROGRAM ELEMENT | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost |
|----------------|---|---------------------------|---------|---------|---------|---------|-------------------------------------|----------------------|
|                |   |                           |         |         |         |         |                                     |                      |
| DK73           | Remotely Monitored Battle-field Sensor System |                           | 3800    | 1400    | 5891    | 4831    |                                     | Not Applicable       |
| DK76           | Field Artillery Acoustic Locating System      |                           | 2250    | 940     | 2018    | 4000    |                                     | Not Applicable       |
|                |   |                           | 1550    | 460     | 3873    | 831     |                                     | Not Applicable       |

BRIEF DESCRIPTION OF ELEMENT: The Program Element consists of two projects: REMBASS (DK73); and FAALS (DK76). REMBASS, the Remotely Monitored Battlefield Sensor System, consists of unattended sensors, relay devices, read-out devices, and power sources. FAALS, the Field Artillery Acoustic Locating System, is designed to locate enemy indirect fire weapons. REMBASS employs a variety of sensor types; FAALS is based on acoustic sensors.

BASIS FOR FY 1978 RDTE REQUEST: REMBASS - Continue direct support to basic system development and initiate theoretical analysis of new/modified configuration and items to meet full Materiel Need (MN) requirements. FAALS - Continue system contract for development of hardware suitable for extensive field testing in order to finalize user community requirements.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Increase in FY 1978 funding for REMBASS - To initiate fabrication of developmental models recommended by theoretical analysis conducted in FY 1977, and for FAALS - To complete Advance Development (AD) hardware construction and to initiate data collection/data reduction efforts and commence extensive field testing of system hardware.

## PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE |  | PROCUREMENT |  | TOTAL |
|----------------------------|------|--|-------------|--|-------|
| (1) Federal Civ. Employees | 60   |  | 0           |  | 60    |
| (2) Contractor Employees   | 130  |  | 0           |  | 130   |
| Total                      | 190  |  | 0           |  | 190   |

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Budget Activity #4 - Tactical Programs

Program Element #6.37.04.A

Title Unattended Ground Sensors (UGS)

DETAILED BACKGROUND AND DESCRIPTION: The purpose of this element is to conduct advanced development (AD) of unattended ground sensor equipment in order to improve the Army's capability to locate targets beyond ground line-of-sight during all conditions of weather and visibility. Specific AD projects include: (a) The Field Artillery Acoustic Locating System (FAALS); and (b) the Remotely Monitored Battlefield Sensor System (REMBASS). The grouping of REMBASS and FAALS under program element 6.37.04.A provides an opportunity for closer coordination within related programs.

RELATED ACTIVITIES: The U.S. Navy and U.S. Air Force utilize the same general technologies in their target acquisition and fire control; U.S. Marine Corps monitors certain developments. Services and Department of Defense programs are closely coordinated and multi-service use of the same devices and facilities is common. Active international programs are maintained with NATO and Quadripartite Working Groups. Work previously initiated by the Defense Special Projects Group and related to ongoing Army programs have been transferred to and are being completed by the Army. Unattended ground sensor (UGS) work for the REMBASS was initiated in FY 1971 under program element 2.36.29.A, Surveillance, Target Acquisition, Night Observation Operations Development and was later transferred to program element 6.37.19.A, Surveillance, Target Acquisition, Night Observation. Program element 6.47.04.A covers the engineering development (ED) aspects of UGS while program element 6.37.19.A and 6.47.23.A, Special Purpose Detectors, cover the AD and ED of surveillance, target acquisition, and night observation (STANO) materiel.

WORK PERFORMED BY: Responsibility for management of the FAALS and REMBASS projects is assigned to Project Manager (PM), REMBASS, US Army Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey. In-house work is performed by the U.S. Army Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey; U.S. Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, Virginia; MERADCOM, Fort Belvoir, Virginia; US Army Armament Research and Development Command (ARRADCOM), Dover, New Jersey; and the U.S. Army Waterways Experiment Station, Vicksburg, Mississippi. Recent contractors include: Honeywell, Inc., Minneapolis, Minnesota; GTE Sylvia, Mountain View, California; MITRE Corp., McLean, Virginia; Applied Physics Laboratory, Johns Hopkins University, Laurel, Maryland; RCA Corp., Camden, New Jersey; Adaptronics, Inc., McLean, Virginia; Analytica, Inc., Philadelphia, Pennsylvania; RESEAL Engineering Corp., Arcadia, California; Chamberlain Manufacturing Corp., Waterloo, Iowa; and General Electric Neutron Devices, St. Petersburg, Florida.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: Prepared Concept Formulation Package (Trade Off Determination, Trade Off Analysis, Best Technical Approach, and Cost/Operational Effectiveness Analysis) and Development Plan to enter engineering development for selected components of REMBASS (basic system). Conducted Validation In-Process Review (IPR) on 6 April 1976; results of In Process Review (IPR) were approved by Department of the Army (DA) on 17 May 1976. Continued work on high-shock lithium-organic batteries, high-shock crystal oscillators, and selected configuration end items required in direct support of ED (6.47.04.A).

Budget Activity #4 - Tactical Programs

Program Element #6.37.04.A

Title Unattended Ground Sensors (UGS)

2. FY 1977 Program: Continuation of AD efforts for high-shock, high-stability, temperature-compensated voltage-controlled crystal oscillators; for high-shock lithium-organic battery suitable for ballistic and air-emplaced sensors; and for a low-cost, hand emplaced imaging sensor that will provide confirmation of target identification.
3. FY 1978 Planned Program: Continuation of advanced development (AD) efforts identified in FY 1977 program. Based on results of FY 1977 tradeoffs, Developmental models will be fabricated. The cutting of hardware in the year is the basis for increased funding of REMBASS. The Field Artillery Acoustic Locating System (FAALS) increase is caused by the starting of the testing program and completion of AD hardware.
4. FY 1979 Planned Program: Completion of high-shock battery and high-shock crystal oscillator efforts. Initiation of airborne relay, commandable sensor, and optimized data display efforts to meet full Remotely Monitored Battlefield Sensor System (REMBASS) Materiel Need (MN) requirements. Initiation of these tasks is a basis for increased REMBASS funding. FAALS funding will decrease because the AD hardware fabrication will be complete.
5. Program to Completion: Continue development of configuration end items to supplement basic REMBASS system and meet full MN requirements.

FY 1978 RDTE DESCRIPTIVE SUMMARY

|                 |                             |                 |   |
|-----------------|-----------------------------|-----------------|---|
| Program Element | <u>#6.37.04.A</u>           | Title           | <u>Unattended Ground Sensors (UGS)</u>                        |
| Project         | <u>#DK73</u>                | Title           | <u>Remotely Monitored Battlefield Sensor System (REMBASS)</u> |
| Category        | <u>Advanced Development</u> | Budget Activity | <u>#4 - Tactical Programs</u>                                 |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to conduct advanced development (AD) of unattended ground sensor equipment included in the Remotely Monitored Battlefield Sensor System (REMBASS) effort in order to improve the Army's capability to provide early warning alert, ground surveillance, and target acquisition beyond line-of-sight during all conditions of weather and visibility. The system will include sensors, data transmission systems, relays, and read-out devices.

RELATED ACTIVITIES:

Services and Department of Defense programs are closely coordinated and multi-service use of the same devices and facilities is common. Active international programs are maintained with NATO and Quadrilateral Working Groups. Work previously initiated by the Defense Special Projects Group and related to ongoing Army programs have been transferred to and are being completed by the Army. Unattended ground sensor (UGS) work for the REMBASS was initiated in FY 1971 under program element 2.36.29.A, Surveillance, Target Acquisition, Night Observation Operations Development, and was later transferred to program element 6.37.19.A, Surveillance, Target Acquisition, Night Observation. Program element 6.47.04.A includes the engineering development (ED) aspects of REMBASS.

WORK PERFORMED BY: Responsibility for management of the REMBASS project is assigned to Project Manager (PM), REMBASS, Fort Monmouth, New Jersey. In-house work is performed by the U.S. Army Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey; U.S. Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, Virginia; ERADCOM, Fort Belvoir, Virginia, Army Research and Development Command, Dover, New Jersey; and the U.S. Army Waterways Experiment Station, Vicksburg, Mississippi. Recent contractors include: GTE Sylvia, Mountain View, California; MITRE Corp., McLean, Virginia; Adaptronics, Inc., McLean, Virginia; Analytics, Inc., Philadelphia, Pennsylvania; and General Electric Neutron Devices, St. Petersburg, Florida.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Prepared Concept Formulation Package (Trade Off Determination, Trade Off Analysis, Best Technical Approach, and Cost/Operational Effectiveness Analysis), Development Plan, and Defense Program Memorandum required to secure approval to enter ED for selected components of REMBASS (basic system). Conducted Validation In-Process Review (IPR) on 6 April 1976; results of IPR were approved by DA on 17 May 1976. Continued work on high-shock lithium-organic batteries, high-shock crystal oscillators, and selected configuration end items required in direct support of ED 6.47.04.A, Unattended Ground Sensors.



Budget Activity #4 - Tactical Programs

Program Element #6.37.04.A

Title Unattended Ground Sensors (UCS)

Project #DK73

Title Remotely Monitored Battlefield Sensor System (REMBASS)

2. FY 1977 Program: Continuation of advanced development (AD) efforts for high-shock, high-stability, temperature-compensated voltage-controlled crystal oscillators; for high-shock lithium-organic battery suitable for ballistic and air emplaced sensors; and for a low-cost, hand emplaced imaging sensor that will provide confirmation of target identification.
3. FY 1978 Planned Program: Continuation of AD efforts identified in FY 1977 program. Based on results of FY 1977 tradeoffs, development models will be fabricated. The fabrication of developmental hardware in the year is the basis for increased funding.
4. FY 1979 Planned Program: Completion of high-shock battery and high-shock crystal oscillator efforts. Initiation of airborne relay, commandable sensor, and optimized data display efforts to meet full REMBASS Materiel Need (MN) requirements. Initiation of these tasks is a basis for increased funding.
5. Program to Completion: Continue development of configuration end items to supplement basic REMBASS system and meet full MN requirements.

RESOURCES: (\$ in Thousands)

|             | FY 1976   | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |  |
|-------------|---|---------|---------|---------|--------------------------|----------------------|--|
| RDTE: Funds | 2250  | 940     | 1050    | 4000    | Continuing               | Not Applicable       |  |
| Quantities  | Not feasible to list due to multitude of items within this project. |         |         |         |                          |                      |  |



FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.37.04.A

Title Unattended Ground Sensors (UGS)

Project #DK76

Title Field Artillery Acoustic Locating System (FAALS)

Category Advanced Development

Budget Activity #4 - Tactical Programs

**DETAILED BACKGROUND AND DESCRIPTION:** The objective of this project is to develop the techniques of sound ranging using a distributed array, and produce an advanced development (AD) system suitable for extensive user tests. The system will include sensors, data transmission system (DTS) (including relays), and input/output devices. The Field Artillery Acoustic Locating System (FAALS) uses a distributed array of acoustic sensors to monitor battlefield artillery activity, transmit blast detection information to a processing center, pinpoint target locations using a computer, and provide information for operator decisions on display devices at the processing center. Feasibility of target location using a distributed array was proven in battlefield situations between 1968 and 1973, and acoustic sensor feasibility has been demonstrated by the Annie Oakley tests conducted in 1973. The distributed array is to be employed using any one of three methods: artillery delivered; air delivered; or hand emplaced. Air delivery will utilize the Surface Emplaced Sensor (SES) developed for the Remotely Monitored Battlefield Sensor System (REMBASS); artillery delivery will utilize the Artillery Delivered Sensor (ADS) projectile also developed for REMBASS. The Hand Emplaced Sensor (HES) may assume the configuration of the other types or a separate configuration of its own.

**RELATED ACTIVITIES:** The U.S. Marine Corps monitors certain developments and is interested in the FAALS, though not providing development funds as originally planned. Program element 6.37.04.A includes the AD aspects of FAALS, and program element 6.47.04.A includes the engineering development (ED) aspects of the program. Program office maintains close liaison with Marine Corps.

**WORK PERFORMED BY:** Responsibility for management of the FAALS project is assigned to Project Manager (PM), REMBASS, US Army Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey. In-house work is performed by the U.S. Army Electronics Research and Development Command (ECOM), Fort Monmouth, New Jersey; the U.S. Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, Virginia; and the US Army Armament Research and Development Command (ARRADCOM), Dover, New Jersey. Major contractors are: Honeywell, Inc., Minneapolis, Minnesota; RESDEL Engineering Corp., Arcadia, California; and Chamberlain Manufacturing Corp., Waterloo, Iowa.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The Army's Unattended Ground Sensor (UGS) development program was initiated in FY 1974 and the FAALS program was assigned to the REMBASS Project Manager's Office in early FY 1975. A preliminary Cost and Operational Effectiveness Analysis was completed; a series of decision risk analyses was initiated to establish a basis for preparing definition and description of the AD system. Work was accomplished on the concept formulation package for the FAALS to include monitoring and evaluating contractual effort in the areas of acoustic sensors, data transmission, processing and display, ballistic delivered sensors, and power sources. Approval was received to develop the FAALS under a Letter of Agreement (LOA)

Budget Activity #4 - Tactical Programs

Program Element #6.37.04.A

Title Unattended Ground Sensors (UGS)

Project #DK76

Title Field Artillery Acoustic Locating System (FAALS)

concept and a draft LOA was completed and submitted to the U.S. Army Materiel Development and Readiness Command (DARCOM) and to the Training and Doctrine Command (TRADOC) for staffing and approval. Award of advanced development (AD), multi-year contracts has been accomplished. Contracts will provide Hand Emplaced Sensor (HES) and continued development of Artillery Delivered Sensor (ADS), Terminal Delivery Vehicle (TDVs), processing center, and portions of the data transmission system (DTS). Overall responsibility for the DTS development will rest with the U.S. Army Electronics Research and Development Command (ERADCOM), including an in-band relay with queueing function and a near-real time capability. Government laboratory concept studies and investigations with contractor support were conducted in high-risk technical areas, including sensor investigations and prototype development for improving detection, discrimination, and range; for microphone selection and positioning with emphasis on wind noise reduction; and for windscreen development as well as package shock testing. Algorithm improvement for gun location, self-survey, and automatic has been implemented.

2. FY 1977 Program: Final designs of the advanced development (AD) hardware under contracts will be selected. Modification of existing equipment and fabrication of interface units and a queueing relay for the DTS will be completed, and Government Furnished Equipment (GFE) delivered to the system contractor. Studies in high risk technical areas will be continued.

3. FY 1978 Planned Program: Program will increase because contractors will complete fabrication of AD hardware and software. Systems integration of components and software in the processing center will be completed by the end of FY 1978 to ensure compatibility and optimize use of the various algorithms. Subsystem integration will also be completed. Portions of the concept formulation package will be finalized as technical decisions and tradeoffs are established during initial testing phases.

4. FY 1979 Planned Program: Program will decrease because fabrication of the AD model will be completed by mid-FY 1979 including systems integration. Development Test/Operational Test (DT/OT) I will be initiated during FY 1979.

5. Program to Completion: DT/OT I will be completed by mid-FY 1980 and preparation for Validation In-Process Reviews (IPR) and entry into Engineering Development (ED) will be completed. Continue AD and systems engineering work on selected areas of the FAALS including sensor discrimination and algorithm improvement to enhance user target location capability and mission planning.

RESOURCES: (\$ in Thousands)

|              | FY 1976   | FY 1977 | FY 1977 | FY 1977 | FY 1978 | FY 1979    | Additional to Completion | Total Estimated Cost | Not Applicable |
|--------------|---|---------|---------|---------|---------|------------|--------------------------|----------------------|----------------|
| ROUTE: Funds | 1550  | 460     | 2000    | 3873    | 831     | Continuing |                          |                      |                |
| Quantities   | Not feasible to list due to multitude of items within this project. |         |         |         |         |            |                          |                      |                |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.05.A

Title Physical Security

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost |
|----------------|---------------------------|---------|---------|---------|---------|-------------------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT | 1999    | 0       | 485     | 500     |                                     | Not Applicable       |
| DK82           | Physical Security         | 1999    | 0       | 485     | 500     | Continuing                          | Not Applicable       |

BRIEF DESCRIPTION OF ELEMENT: Objective is to conduct advanced development of a family of physical security sensors and ancillary equipment that will operate worldwide, enabling commanders to tailor physical security systems to protect assets, installations, bases, facilities, and personnel.

BASIS FOR FY 1978 RDTE REQUEST: Accomplish advanced development of components to provide additional capabilities for the Basic Facility Intrusion Detection System (FIDS) in full scale development under program element #6.47.18.A, Physical Security. Components to interface with the FIDS will be procured and evaluated in-house to demonstrate concept feasibility. Items to be procured include sensors, response/deterrent devices, and cargo security devices.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Program element was not funded in FY 1977; increase due to resumption of work.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 5    | 0           | 5     |
| (2) Contractor Employees   | 5    | 0           | 5     |
| Total                      | 10   | 0           | 10    |

Budget Activity #4 - Tactical Programs

Program Element #6.37.05.A

Title Physical Security

DETAILED BACKGROUND AND DESCRIPTION: Objective is to conduct all design, development, test, and evaluation required to provide the technological base and establish the concept feasibility necessary to proceed into engineering development of complete, integrated physical security systems to protect materiel, bases, facilities, installations, and personnel against theft, sabotage, or espionage. Developments will be directed towards satisfying the Army's Materiel Need (MN) for a Facility Intrusion Detection System (FIDS). Approach is to provide overall system overview via a "Systems Analysis" task and to develop, under a number of other tasks, (1) sensors, including penetration, motion, item removal, duress, and contraband; (2) electronic data links, data link security supervisory components, and centralized data processing components; (3) alarm display, monitoring, and readout components; (4) physical or psychological deterrent devices that will respond automatically to an alarm; (5) devices to protect cargo in depots or in transit by truck, rail, or ship; and (6) standardized weapons and key containers. In addition, there will be a continuing evaluation of appropriate commercial sensors as well as those that might be developed by other government agencies.

RELATED ACTIVITIES: This program leads into Engineering Development Program Element 6.47.18.A, Physical Security. The Basic Facility Intrusion Detection System is being developed under that program element to provide interior intrusion detection systems to all Department of Defense (DOD) elements. Related are the Army's Remotely Monitored Battlefield Sensor System (REMBASS) tactical sensor program, and the Air Force's Base and Installation Security System (BISS) exterior physical security program. Also related is the Army's Required Operational Capability (ROC) for a Fixed Installation Exterior Perimeter Sensor System (FIEPSS) which is currently not being developed because of the BISS program. Close coordination with REMBASS and BISS is being accomplished to assure utilization of related technologies and developments and to prevent duplication of effort. Coordination is accomplished by members of joint working groups and by attendance at pertinent meetings. The DOD Physical Security Action Group monitors and coordinates the development and acquisition of physical security equipment by all services. The Department of Army Physical Security Review Board (DAPSRB) directly monitors the development, acquisition and installation of Army physical security systems.

WORK PERFORMED BY: The US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, Virginia is assigned responsibility for Physical Security Research, Development, Test and Evaluation (RDTE). Other government agencies currently involved are the US Army Test and Evaluation Command, Aberdeen, Maryland, and the US Army Natick Research and Development Command (NARADCOM), Natick, Massachusetts for development of secure containers. Major contractors are LaBarge Electronics Division, Tulsa, Oklahoma; GTE Sylvania, Mountaintop, California, and Aerospace Research, Inc., Boston, Massachusetts.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: Advanced development in pursuance of the approved Materiel Need (MN) for the Facility Intrusion Detection System (FIDS) was initiated during FY 1974 under PE 6.37.19.A, Special Purpose Detectors. A development plan was completed, concept formulation was demonstrated, and a Concept Feasibility In-Process Review was conducted during June 1974. The In-Process Review (IPR) authorized full scale development of a Basic FIDS and continuing Advanced Development of an Advanced FIDS. Project DK82 was unfunded during FY 1975. During FY 1976 an analysis of physical security requirements was conducted including attack and threat scenarios, site functional requirements, and site parameters to insure development of physical security systems meeting both materiel and user requirements. The Engineering Development (ED) models of the FIDS sensors, power



Budget Activity #4 - Tactical Programs

Program Element #6.37.05.A

Title Physical Security

supply, and control, communication, and display subsystem (CC&DS) were tested and evaluated. Based upon this, the CC&DS was completed, reconfigured and rearchitected. The CC&DS can interface with military and commercial sensors. Contracts were prepared and awarded for the Development Test II/Operational Test II (DT II/OT II) models. In the cargo protection area, package alarms, vehicle trackers, electronic and optical tagging techniques and remotely activated vehicle alarms were surveyed to determine suitability for use in FIDS. Mobility Equipment Research and Development Command (MERADCOM) tasked Natick Research and Development Command (NARADCOM) to prepare requirements documents and procure Advanced Development (AD) models for a standard weapons container for weapons which do not currently have standard arms racks and for a standard container for arms room keys which will offer resistance to penetration equivalent to that of arms rooms. MERADCOM coordinated this effort to insure compatibility with sensor equipment which will be incorporated into the containers. In the equipment evaluation area, the major effort was in the evaluation of commercial and military equipment for use in FIDS. Countermeasure techniques were investigated, and the threat reassessed. Project DK82 was not funded in FY 1977.

2. FY 1977 Program: Not applicable.

3. FY 1978 Planned Program: Increase in funding because during FY 1978 work will be resumed in the areas of (1) systems analysis; (2) sensors; (3) data links and related items; (4) cargo protection devices; and (5) standardized weapons containers. Effort will be initiated to develop and procure AD models of physical or psychological deterrent devices. Effort will continue in the evaluation of commercial equipment and equipment that might be developed by other government agencies.

4. FY 1979 Planned Program: Continuation of Advanced Development of components procured in FY 1978. Hardware procured in FY 1978 will be evaluated and modified as required to demonstrate concept feasibility.

5. Program to Completion: Continuing.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.07.A

Title Communications Development

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost |
|----------------|--|---------|---------|---------|---------|-------------------------------------|----------------------|
|                |  |         |         |         |         |                                     |                      |
|                | TOTAL FOR PROGRAM ELEMENT Quantities                   | 1528    | 1603    | 5236    | 9600    | Not Applicable                      | Not Applicable       |
| D137           | Joint Tactical Information Distribution System (JTIDS) | 100     | 8       | 1840    | 3700    | Continuing                          | Not Applicable       |
| D245           | Defense Communications System (DCS)/Army Comm Adv Dev  | 563     | 425     | 1889    | 3275    | Continuing                          | Not Applicable       |
| D246           | Tactical Comm Dev                                      | 85      | 0       | 538     | 442     | Continuing                          | Not Applicable       |
| D437           | Tactical Radio Comm System                             | 780     | 1170    | 969     | 2183    | Continuing                          | Not Applicable       |

BRIEF DESCRIPTION OF ELEMENT: The Advanced Development of Army tactical and strategic communications equipment and associated supporting items and techniques is conducted in this program. Primary emphasis is on equipments and systems which are directed toward the conversion from analog to digital techniques.

BASIS FOR FY 1978 RDTE REQUEST: Continue to participate in the Joint Tactical Information Distribution System (JTIDS) program. Complete a power amplifier for tropospheric scatter transmission. Initiate contract effort for Cable Fault Locator and Emergency Action Console. Continue to monitor state-of-the-art advancements in solid state scanner and recognition techniques. Establish contracts for Advanced Development models of fiber optic cable systems and hybrid millimeter wave integrated circuit transceiver. Continue tactical antenna, vehicular intercom and audio transducer projects.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The increase in funding over the FY 1977 level is due to award of advanced development contracts in the JTIDS program.

Budget Activity #4 - Tactical Programs

Program Element #6.37.07.A

Title Communications Development

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 84          | 0                  | 84           |
| (2) Contractor Employees   | 37          | 0                  | 37           |
| Total                      | 121         | 0                  | 121          |

DETAILED BACKGROUND AND DESCRIPTION: The Joint Tactical Information Distribution System (JTIDS) is a joint Service program to develop and acquire an integrated communication, navigation, identification system which is secure and jam resistant. It is to serve a variety of weapon systems in a tactical environment. In the Defense Communications System and Army Communications System, specific tasks include Digital Transmission, Data Terminals, Systems Control, Digital Access Area Switch System, Communications Emergency Action Console, and Cable Fault Locator. In Tactical Communications Development, to develop efficient input/output devices for transmission of communications in a tactical environment and to develop equipments for trunk transmission.

RELATED ACTIVITIES: Exploratory development for this program is performed in Program Element 6.27.01.A, Communications Electronics. As equipment development in this program completes Advanced Development, it will proceed into Engineering Development in Program Element 6.47.01.A, Communications Engineering Development. Effort will support the development of SINGCARS in Program Element 6.37.46.A, beginning in FY 1978. All efforts are closely coordinated with the efforts in Program Element 2.80.10.A, TRI-TAC Program. Project D244, Advanced Development Test Equipment, has been transferred from this program to Program Element 6.37.48.A, Automatic Test Equipment.

WORK PERFORMED BY: US Army Communications Research and Development Command and the US Army Communications System Agency, both of Fort Monmouth, New Jersey. Contractors include: Varian Associates, Palo Alto, California; Collins Radio, Dallas, Texas; Martin Marietta, Inc., Orlando, Florida; Raytheon Company, Wayland, Massachusetts; Harris Corporation, Melbourne, Florida; Lockheed Research Corporation, Palo Alto, California; and Cincinnati Electronics, Cincinnati, Ohio.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: Contracts were awarded for an efficient reliable High Power Amplifier Tube and an Adaptive Antenna Control. Continued effort on a low profile vehicular antenna, a transceiver multicoupler, and a noise cancelling

Budget Activity #4 - Tactical Programs

Program Element #6.37.07.A

Title Communications Development

microphone. Advanced Development was continued on a Very High Frequency (VHF) manpack whip antenna and capacitive tuning element. Participated in studies related to Army application of Joint Tactical Information Distribution System (JTIDS). Participated in Digital Transmission and started Digital Access Area Switched Systems for the Defense Communications System.

2. FY 1977 Program: Complete development of Power Amplifier Tube and Adaptive Antenna Control. Continue effort for Tactical Automatic Message Entry Equipment (TAMME) and monitor fiber optic cable development. Complete efforts on low profile VHF antenna for armored vehicles, an efficient center fed manpack whip antenna, and noise cancelling microphone. Initiate Advanced Development on vehicular intercom system. Continue the Digital Transmission and the Digital Access Area Switched Systems efforts for the Defense Communications System. Continue to participate in the JTIDS program.
3. FY 1978 Planned Program: Initiate contract effort for Cable Fault Locator and Emergency Action Console. Continue Digital Access Area Switched Systems effort. Initiate Advanced Development for hand printed message entry equipment and contracts for fiber optic cable system. Continue vehicular intercom and audio transducer projects. Increase in FY 1978 funds over FY 1977 is due to award of advanced development contracts in the JTIDS program.
4. FY 1979 Planned Program: Continue Digital Access Area Switch System, Emergency Action Console, and Cable Fault Locator. Continue hand print message entry task. Continue developments started in prior years. Increase in funds due to purchase and testing of two prototype vehicular intercom systems, and continued effort in the JTIDS program.
5. Program to Completion: This is a continuing program.

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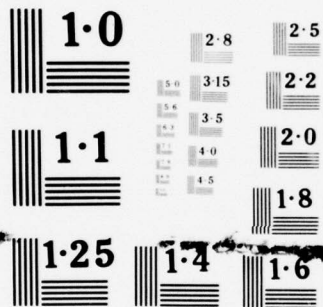
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FY 1978 RDT&E DESCRIPTIVE SUMMARY

|                               |  |
|-------------------------------|--|
| Program Element #6.37.07.A    | Title Communications Development   |
| Project #D137                 | Title Joint Tactical Information Distribution System (JTIDS) Development |
| Category Advanced Development | Budget Activity #4 - Tactical Programs                                   |

DETAILED BACKGROUND AND DESCRIPTION: The Joint Tactical Information Distribution System (JTIDS) program was established by the Department of Defense in September 1974. The Air Force is the designated lead Service and has established a Joint Program Office at the Electronics System Division, Air Force Systems Command, (AFSC) and has assigned a Program Manager. All Services have assigned Deputy Program Managers to serve at the Joint Program Office. The purpose of the program is to develop and acquire an integrated communication, navigation, and identification system which is secure and jam resistant and designed to interconnect the Services' command and control and weapons systems in a joint tactical environment. The Army portion of the Joint Program Office staff consists of a Deputy Program Manager and nine other employees, six civilians and three military. In addition to Joint Service responsibilities, the Army Deputy Program Manager has been tasked to develop and acquire the Class 3 (Manpack) terminal.

RELATED ACTIVITIES: This program is related to both the Tactical Air Control Systems/Tactical Air Defense Systems (TACS/TADS) and the Ground and Amphibious Military Operations (GAMO) Joint Service Interoperability Programs. JTIDS will interconnect elements involved in these programs and it is essential that the JTIDS design satisfy the data exchange requirements of various tactical command and control facilities/systems involved in these programs and conform to the interface standards of TACS/TADS and GAMO. Service systems involved include Air Force Airborne Warning and Control System (AWACS) and Army systems AN/TSG-73, PATRIOT, SAM-D, TOS, and TACTIRE.

WORK PERFORMED BY: The Air Force, as lead Service, provides a Program Manager (PM) who is responsible for overall management of the program during development and acquisition of the system. Deputy Program Managers (DPMS) are provided by the Services and assigned to the Joint Program Office (JPO). The DPMS, in addition to their joint duties, are the single points of contact within the JPO between their Services and the PM. Each DPM is JTIDS PM for his Service. He is responsible for Service unique requirements, controlling Service funds, and administrative control of personnel from his Service assigned to the JPO. The JTIDS program is supported by the Joint Logistics Commanders and the Air Force Logistics Command provides primary logistic support to the PM. The Army DPM and his staff are provided by PM ARTADS.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The Army Deputy Program Manager was assigned and the Army Joint Program Office staffing completed, the initial Army JTIDS program was formulated, Class 3 terminal development planning was initiated, the JTIDS/PATRIOT concept study was started, and potential Army applications of JTIDS were pursued through briefings/discussions with user community.

Budget Activity #4 - Tactical Programs

Program Element #6.37.07.A

Project #D137

Title Communications Development

Title Joint Tactical Information Distribution System (JTIDS) Development

1. FY 1977 Program: The Joint Tactical Information Distribution System (JTIDS)/PATRIOT Concept Study will be completed, contract awards for Class 3 Terminal design and tradeoff analysis will be accomplished, a Force Development test and evaluation program will be formulated, an integrated Logistic Support Plan and a Test and Evaluation Master Plan will be developed, and coordination with the user community to define Army requirements will be continued.

2. FY 1978 Planned Program: The Class 3 Terminal study results will be analyzed, the data provided to US Army Training and Doctrine Command for evaluation, undertake preliminary actions leading up to contract awards for advanced development for the Class 3 (manpack) Terminal before the end of FY 1978, and initiate Force Development test and evaluation. Increase in funding over the FY 1977 level is due to awarding of advanced development contracts for the Class 3 Terminal and Force Development test initiation.

3. FY 1979 Planned Program: The Advanced Development contracts for Class 3 Terminals will continue, prototype Class 1 and 2 terminals will be acquired, and Army unique testing will be initiated. Increase in funding over the FY 1978 level is due to terminal acquisition and Army unique testing.

4. Program to Completion: This is a continuing program.

RESOURCES: (\$ in Thousands)

|            | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost | Not Applicable |
|------------|---------|---------|---------|---------|--------------------------|----------------------|----------------|
| DTE: Funds | 100     | 8       | 850     | 3700    | Continuing               |                      |                |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.07.A

Title Communications Development

Project #D245

Title Defense Communications System (DCS)/Army Communications  
Advanced Development

Category Advanced Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is the advanced development of equipment and systems for both the Defense Communications System and Army Communications Systems. Primary emphasis is on equipments and systems which are directed toward the conversion of the Defense Communication System to an all-digital network and to the interface of Army Communications Systems with this network. Specific tasks include Digital Transmission, Data Terminals, Systems Control, Digital Access Area Switch System, Communications Emergency Action Console, and Cable Fault Locator.

RELATED ACTIVITIES: Program Element 6.47.01.A, Communications Equipment Development, provides engineering development follow-on effort for this project.

WORK PERFORMED BY: Project management is performed by US Army Communications Systems Agency, Fort Monmouth, New Jersey. In-house support is by US Army Electronics Research and Development Command, Fort Monmouth, New Jersey; and by Department of Commerce, Boulder ITS Labs, Boulder, Colorado. Contractors include Varian Associates, Palo Alto, California and Signatron, Lexington, Massachusetts.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Prior to 1976, work on this project was negligible. In FY 1976 and FY 1977, contracts were initiated for an efficient reliable High Power Amplifier Tube and an Adaptive Antenna Control, both for digital Tropospheric scatter (Troposcatter) applications. In-house effort was started for concept formulation on a local digital distribution system, digital access area switch system, and an emergency action console.
2. FY 1977 Program: Advanced development on the efficient reliable High Power Amplifier Tube and the Adaptive Antenna Control will be completed. A contract will be initiated for a high power amplifier. In-house effort will begin on an adaptive multiplexer, remote power equipment, performance assessment, and status monitoring devices and a Cable Fault Locator. In-house effort will continue on and contracts will be let for the local digital distribution system, Digital Access Area Switch System (DAASS) and a communications Emergency Action Console. Maximum advantage will be taken of the AF sponsored Emergency Action Console developments. Funds were reprogrammed from PE 6.47.01.A, Communications Equipment Development, to accomplish the above.
3. FY 1978 Planned Program: In Digital Transmission: Complete a power amplifier for Troposcatter transmission, continue in-house effort on multiplexing. In Data Terminals, initiation of in-house concept development. Continue in-house and contract support for

Budget Activity #4 - Tactical Programs

Program Element #6.37.07.A

Project #D245

Title Communications Development

Title Defense Communications System (DCS)/Army Communications  
Advanced Development

a digital area access switch system. Initiate contract effort for Cable Fault Locator and an Emergency Action Console. Initiate contracts for systems control functions. Major elements of increase in FY 1978 over FY 1977 are contract costs for system control, Emergency Action Console, Cable Fault Locator and Digital Access Area Switch System.

4. FY 1979 Planned Program: Continue Digital Access Area Switch System, Emergency Action Console, and Cable Fault Locator. Continue in-house concept definition for adaptive multiplexer and initiate contract effort for data terminal equipment development. Continue DCS System Control. Increased cost of FY 1979 over FY 1978 is a result of increased effort and contract costs on all projects.

5. Program to Completion: This is a continuing program.

RESOURCES: (\$ in Thousands)

|             | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional<br/>to<br/>Completion</u> | <u>Total<br/>Estimated<br/>Cost</u> |
|-------------|----------------|----------------|----------------|----------------|---|-------------------------------------|
| RDTE: Funds | 563            | 425            | 1784           | 3275           | Continuing                              | Not Applicable                      |



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.11.A Title Tactical Self-Protection Electronic Warfare Equipment

Category Advanced Development Budget Activity 4 - Tactical Programs

RESOURCES /PROJECT LISTING/ (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT                    | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost<br>Not Applicable |
|----------------|---|---------|---------|---------|---------|-------------------------------------|--|
| D653           | Tactical Self-Protection Electronic Warfare Equipment | [       | [       |         |         | Continuing                          | Not Applicable                         |

BRIEF DESCRIPTION OF ELEMENT: Beginning in FY 1978, PE #6.37.11.A consists of one project; D653, Tactical Self-Protection Electronic Warfare Equipment. The objective of this project is to establish the technical feasibility and military potential of electronic countermeasures (ECM) equipment, and electronic warfare support measures (ESM) equipment for protection of Army aircraft in a hostile air defense environment composed of radar, infrared (IR) and optically directed weapon systems.

BASIS FOR FY 1978 RDTE REQUEST: Planned programs for FY 1978 include continuation or completion of tasks initiated in prior years; such as, advanced

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The FY 1978 program continues FY 1977 efforts and initiates efforts in [



Budget Activity #4 - Tactical Programs

Program Element #6.37.11.A

Title Tactical Self-Protection Electronic Warfare Equipment

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 6           | 0                  | 6            |
| (2) Contractor Employees   | 41          | 0                  | 41           |
|                            | <u>47</u>   | <u>0</u>           | <u>47</u>    |
| Total                      |             |                    | 47           |

DETAILED BACKGROUND AND DESCRIPTION: Since its inception in 1971, this program has been the vehicle for development of electronic countermeasures (ECM) and electronic warfare support measures (ESM) equipment for Army aircraft. The approach is to develop measurement and evaluation techniques, standards, and equipments; develop prototype ECM/ESM equipment and associated ground support equipment; and conduct the tests, measurements, and evaluations required to demonstrate concept feasibility and military potential.

RELATED ACTIVITIES: This program element interfaces with and is complemented by Program Element #6.32.08.A, Aircraft Survivability Concepts. Other related electronic warfare developments are conducted by the Air Force and Navy. Interservice coordination to maximize the exchange of technical data and minimize duplication of effort is effected by joint participation of subgroups and working panels of the Technical Cooperation Programs and by the Joint Tri-Service Electronic Warfare Panel. In addition, formal requirements documents of each service are exchanged, reviewed, and commented upon by the other services. Coordination is also accomplished as part of the program reviews conducted by the Office of the Secretary of Defense (Director of Defense Research and Engineering).

WORK PERFORMED BY: US Army Aviation Research and Development Command (AVRADCOM), St. Louis, MO; US Army Electronics Research and Development Command (ERADCOM), Electronic Warfare Laboratory, Ft. Monmouth, NJ; US Army Armament Research and Development Command (ARRADCOM), Dover, NJ. Contractors: Sanders Associates, Incorporated, Nashua, NH; ITT Corporation, Nutley, NJ; TRACOR Incorporated, Austin, TX; Hughes Helicopter, Culver City, CA; Aerojet ElectroSystems Company, Cincinnati, OH; Riverside Research Institute, New York, NY; CALSPAN Corporation, Buffalo, NY; Stanford Research Institute, Palo Alto, CA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

FY 1977, FY 1976, and Prior Accomplishments: A number of competitive systems were evaluated during an extensive series of field tests during FY 1974 - FY 1976 resulting in a program. The technical feasibility of an optical contrast reduction system was proven, but not developed further due to excessive weight and power requirements. The interface of the AN/APR-39 Radar Warning Receiver with a sophisticated processor was completed and tested

**Budget Activity #4 - Tactical Programs**

| Program Element | #6.37.11.A | Title | Tactical Self-Protection Electronic Warfare Equipment |
|-----------------|------------|-------|---|
|                 |            |       |   |

on the US Air Force Dynamic Electromagnetic Environment Simulator (DEES). This program, the AN/APR-39(V)2, has entered the AN/ALQ-136 radar jammer was successfully flight tested against the

Study efforts were conducted to evaluate optical warning receiver application for helicopters. Investigations were conducted to upgrade the AN/ALQ-147 IR jammer output in the wave warning receivers were developed for integration into the AN/APR-39 system. An advanced radar jamming techniques program was conducted for Project Grenade Box. Development of a high resolution laser warning receiver was initiated. Development was also initiated for an optical warning location/detection system.

2. FY 1977 Program: The following on-going tasks will be continued:

### 3. FY 1978 Planned Program: Continuation of on-going tasks:

4. FY 1979 Planned Program: Research will support on-going efforts to facilitate progressing into The increased funding in FY 1979 is associated with initiating programs for an advanced.

5. Program to Completion: Continuing program.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.12.A

Title Mapping and Geodesy

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/ (\$ in Thousands)

| Project Number | Title   | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|---|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | TOTAL FOR PROGRAM ELEMENT                               | 300     | 817     | 1072    | 2279    |                                     |                                     |
|                | Quantities:   |         |         |         |         |                                     |                                     |
|                | Prototype Analytical Photogrammetric Positioning System |         |         |         |         |                                     | 1                                   |
|                | Prototype Quick Reaction Multicolor Printer             |         |         |         |         |                                     | 1                                   |
|                | Prototype Integrated Survey Instrument                  |         |         |         |         |                                     | 1                                   |
|                | Prototype Forward Observer Direction Finder             |         |         |         |         |                                     | 1                                   |
|                | Prototype Forward Area Survey Equipment                 |         |         |         |         |                                     | 1                                   |
|                | Prototype Army Terrain Information Systems              |         |         |         |         |                                     | 1                                   |
| D580           | Field Army Mapping                                      | 0       | 120     | 707     | 529     | Continuing                          | Not Applicable                      |
| D673           | Field Army Surveying                                    | 300     | 307     | 117     | 729     | Continuing                          | Not Applicable                      |
| D862           | Terrain Data Developments                               | 0       | 50      | 248     | 1021    | Continuing                          | Not Applicable                      |

BRIEF DESCRIPTION OF ELEMENT: The objectives of this advanced development program are to develop techniques, software, and equipment for Army mapping, surveying, and Military Geographic Intelligence activities in direct support of Field Army tactical deployment of forces and weapon system operation. Major elements of the program are the development of an Army Terrain Information System, an Analytical Photogrammetric Positioning System, an Integrated Survey Instrument, a Forward Observer Direction Finder, Forward Area Survey Equipment, and advanced components to upgrade the Topographic Support System. This program addresses present deficiencies in the Army's ability to provide topographic data and field artillery fire control positioning in a timely manner consistent with rapid and effective combat operations.

BASIS FOR FY 1978 RDTE REQUEST: Complete fabrication and testing of the prototype Analytical Photogrammetric Positioning System. Continue advanced development of special map products displaying geographic information pertinent to combat operations. Begin contract fabrication of the prototype Quick Reaction Multicolor Printer. Begin advanced development of the Map Illuminator.

BASIS FOR INCREASE IN FY 1978 OVER FY 1977: The funding increase is needed to fund fabrication of the prototype Quick Reaction Multicolor Printer and to initiate development of the Map Illuminator.

Budget Activity #4 - Tactical Programs

Program Element #6.37.12.A

Title Mapping and Geodesy

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 6           | 0                  | 6            |
| (2) Contractor Employees   | 20          | 0                  | 20           |
| Total                      | 26          | 0                  | 26           |

**DETAILED BACKGROUND AND DESCRIPTION:** The objectives of this program are the development of techniques, materiel and equipment to support rapid acquisition, processing and dissemination of position location, mapping, and other terrain data. These objectives are in direct support of the tactical deployment of forces and the operation of weapons systems. This program element includes work on the following systems: (1) development of a prototype Advanced Analytical Photogrammetric Positioning System (AAPPS) which will cost effectively provide position coordinates of friendly and target locations; (2) development of an Army Terrain Information System (ARTINS), which will be an integral part of and in support of the Automated Data System for the Army in the field and satisfy field commander requirements for terrain and topographic information; (3) development of a Quick Reaction Multicolor Printer which will permit rapid reproduction of relatively small quantities of topographic products; (4) development of a Map Illuminator which will permit map users in the field to view maps in darkness without disclosing their positions; (5) development of a Factor Map Synthesizer which will speed up and simplify preparation of special topographic products in the field; (6) development of an Advanced Map Update Capability to speed up and simplify revisions in the field; (7) development of an Integrated Survey Instrument which will permit Field Artillery Units to conduct local area surveys with less equipment and fewer personnel; (8) development of a Forward Observer Direction Finder which will permit forward observers to obtain more accurate azimuths and thereby locate targets more accurately; and (9) development of vehicle mounted Forward Area Survey Equipment which will be capable of meeting the essential requirements of the Position and Azimuth Determining System. In FY 1972 and prior years, this program element also included funding for RDTE in support of the Army's base plant map production facility. The management of the base plant facility and related RDTE, however, was transferred to the newly created Defense Mapping Agency (DMA) on 1 July 1972. The data on the base plant RDTE efforts will therefore be included in the DMA program submission.

**RELATED ACTIVITIES:** The Army works directly with Air Force, Navy and Marine Corps, and under the coordination of DMA and the Director of Defense Research and Engineering in the functional area of Mapping and Geodesy. Specific related program elements are as follows: DMA Program Element 6.37.01.B, Mapping, Charting and Geodesy Investigations and Prototype Development; DMA Program Element 6.47.01.A, Mapping, Charting and Geodesy Engineering Development and Test; Army Program Element 6.27.07.A, Mapping and Geodesy; and Army Program Element 6.47.16.A, Mapping and Geodesy.



**Budget Activity #4 - Tactical Programs**

Program Element #6.37.12.A

Title Mapping and Geodesy

WORK PERFORMED BY: This program is the responsibility of the US Army Engineer Topographic Laboratories (USATL) at Fort Belvoir, VA, with approximately 50 percent of the work accomplished internally. The remainder is performed by contractors. The major contractors are: Litton Systems, Incorporated, Woodland Hills, CA; IDEAS, Incorporated, Beltsville, MD; Bausch and Lomb, Rochester, NY; DBA Incorporated, Melbourne, FL; and Dell Foster, San Antonio, TX. All contracts exceed \$25,000.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Until 1967, the activities in this program element were carried out under the exploratory development element 6.27.07.A. In 1967, advanced development of the all-weather radar mapping system, the automatic cartography system and exploitation of the reconnaissance photography was initiated. Initiated development of prototype special map products designed to support infantry and airborne operations in hostile areas in 1970. The advanced development and testing of a radar signal processor, which created photographic imagery from the recorded radar signals, was completed in 1970. In 1971, a High Resolution Orthophoto Output Table to allow for the composite production of an entire map sheet from automated map compilation was completed. An Automatic Point Transfer Instrument was also completed. It permits highly accurate and rapid transfer, marking and measurement of photographic control points for the production of topographic maps. Design and development of a prototype Position and Azimuth Determining System (PADS) was initiated. In 1972, a device for obtaining digital elevation data from a Cigas-Zeiss map plotter was built and tested and prototype special map products to support battlefield sensor operations were completed. The design and development of an enlarging printer, an automatic rescan (grid) measuring device, a device for the production of high resolution orthophoto maps and a prototype Electronic Image Reproducer that will provide a quick-reaction map printing capability for tactical forces were initiated. In 1973, the design, development and testing of the prototype doppler position location system was completed. In 1974, completed the test, evaluation and tradeoff analysis for the jeep-mounted PADS. Initiated contractual studies and experimentation of the problems of operating a PADS in a helicopter. In 1975, completed studies on helicopter operation of the Position and Azimuth Determining System. Initiated advanced development of an Advanced Analytical Photogrammetric Positioning System. In 1976, negotiation of a contract for development of a prototype Advanced Analytical Point Positioning System began. An in-house correlation facility was assembled to support development of a target reference scene generation capability for the PERSHING II missile during FY 1977. Hardware to demonstrate the Army Terrain Information System concept was also procured.

2. FY 1977 Program: The Advanced Analytical Photogrammetric Positioning System (AAPS) contract will be awarded and continue through the period. Development work on field generation of PERSHING II reference scenes will be continued using PII funds. The Army Terrain Information System (ARTINS) will be demonstrated. Development of a Quick Reaction Multicolor Printer will begin. A prototype Built-Up Area product will be compiled and tested.



Budget Activity #4 - Tactical Programs

Program Element #6.37.12.A

Title Mapping and Geodesy

3. FY 1978 Planned Program: The Advanced Analytical Photogrammetric Positioning System will be delivered and tested. The prototype Quick Reaction Multicolor Printer will be fabricated. Compilation and testing of four "topical" graphics products will be completed. Development of a Map Illuminator will be initiated. Increased funds over FY 1977 are required for the procurement of the prototype Quick Reaction Multicolor Printer.

4. FY 1979 Planned Program: Evaluation of the Advanced Analytical Photogrammetric Positioning System will be completed, a ROC will be staffed, and the program will move to engineering development. The prototype Quick Reaction Multicolor Printer will be tested and a ROC will be staffed for engineering development. Prototype Map Illuminators will be fabricated and testing will begin. Development of the Mini Map Viewer, the Factor Map Synthesizer, the Integrated Survey Instrument, the Forward Observer Direction Finder, and the Forward Area Survey Equipment will be initiated. Contracts will be awarded for design and fabrication of prototype models of all of these items. Army Terrain Information System software will be developed under contract. Compilation and testing of four more "topical" graphic products will be completed. Increase in funds for FY 1979 is required to support contractual effort stated above.

5. Program to Completion: The developments active during FY 1979 will be completed during FY 1980 and FY 1981, and moved on to engineering development. Development of an Advanced Map Update Capability, a Map Reproducible Reduction and Enlargement System, a Line of Sight Plotter, a Terrain Visualizer, Advanced Gyro Technology, and additional topographic products will be carried out during these years.

6. Major Milestones:

|  | Date       | Estimated RDTE Cost to Reach Events (Cumulative) |
|--|------------|--|
| a. Complete Advanced Development of Advanced Analytical Photogrammetric Positioning System | 1Q FY 1979 | \$ 919,000                                       |
| b. Complete Advanced Development of Quick Reaction Multicolor Printer                      | 4Q FY 1979 | \$1,116,000                                      |
| c. Complete Advanced Development of Map Illuminator  | 1Q FY 1980 | \$ 200,000                                       |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.18.A Title Electronic Warfare Vulnerability/Susceptibility

Category Advanced Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/ (\$ in Thousands)

| Project Number | Title   | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|---|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | <b>TOTAL FOR PROGRAM ELEMENT</b>                                |         |         |         |         |                                     |                                     |
| D190           | Tri-service Electro-optics Weapons Vulnerability/Susceptibility |         |         |         |         | Continuing                          | Not Applicable                      |
| D267           | Missile Vulnerability/Susceptibility                            |         |         |         |         | Continuing                          | Not Applicable                      |
| D626           | Non Missile Vulnerability/Electronic Counter-Countermeasures    |         |         |         |         | Continuing                          | Not Applicable                      |

**BRIEF DESCRIPTION OF ELEMENT:** This program examines missile, communications-electronic and electro-optics systems to discover their weaknesses to enemy electronic warfare, and makes recommendations to the system developers on how to reduce to eliminate those weaknesses. The program consists of 17 task areas, four for communications-electronics equipment, 12 for missile systems, and one for Tri-service electro-optics systems.

**BASIS FOR FY 1978 RDTE REQUEST:** Funds are required to continue testing US systems against electronic countermeasures. New items of test equipment must be obtained to support realistic testing of PATRIOT and other air defense missile systems. Jammers must be fabricated to support testing of PATRIOT. Special Electromagnetic Interference (SEMI) work will expand to include systems. Support to developers of communications-electronics systems will accelerate.

Budget Activity #4 - Tactical Programs

Program Element #6.37.18.A

Title Electronic Warfare Vulnerability/Susceptibility

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: This program is composed of 17 tasks whose requirements vary with time. Increase is caused by additional requirements to support PATRIOT and other Air Defense Missile tests, and to accelerate support to developers of communications-electronics systems.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 260  | 0           | 260   |
| (2) Contractor Employees   | 137  | 0           | 137   |
| Total                      | 397  | 0           | 397   |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is four fold: first, determine the susceptibility to electronic countermeasures (ECM) of US Army missile systems and non-missile communication and electronic equipment; second, determine the ECM vulnerability of enemy tactical missiles representing a threat to the tactical commander; third, develop prototype electronic warfare systems to exploit the ECM vulnerability of enemy electronic systems; and fourth, provide to US Army developers recommendations on electronic counter countermeasures (ECM) circuits and devices for both missiles and non-missile electro-magnetic systems that will reduce the vulnerability of US systems to enemy electronic warfare operations. There are three projects in this program element: DL90, Tri-service Electro-optics Weapons Vulnerability/Susceptibility; D267, Missile Vulnerability/Susceptibility, and D626, Non-missile Vulnerability/Susceptibility.

RELATED ACTIVITIES: Other related research and studies are performed by the Air Force and Navy. Coordination is accomplished by exchange of technical reports, attendance at scientific meetings and conferences, joint development projects and reviews conducted by the Office of the Secretary of Defense (Director of Defense Research and Engineering).

WORK PERFORMED BY: In-house research, development, exploitation, and missile system susceptibility analysis are conducted by the Office of Missile Electronic Warfare, Electronic Warfare Laboratory, White Sands, New Mexico. Major contractor support is provided by GIE, Sylvania, Mountain View, California; Cincinnati Electronic Corporation, Cincinnati, Ohio; AVCO, Wilmington, Massachusetts; New Mexico State University, Las Cruces, New Mexico; General Dynamics, Fort Worth, Texas; Georgia Tech Research

Budget Activity #4 - Tactical Programs

Program Element #6.37.18.A

Title Electronic Warfare Vulnerability/Susceptibility

Institute, Atlanta, Georgia; Harris Corporation Electronics System, Palm Bay, Florida; Hughes Aircraft Corporation, Fullerton, California; Rockwell International, Anaheim, California, University of Illinois, Urbana, Illinois; Hazeltine Corporation, Greenlawn, New York; American Electronic Laboratories, Inc., Lansdale, Pennsylvania; Computer Sciences Corporation, Falls Church, Virginia.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Electronic Countermeasures (ECM) vulnerability studies were conducted on PERSHING, SERGEANT, LANCE, NIKE-HERCULES, HONEST JOHN, CORPORAL, SHILLELAGH, DRAGON, and TOW missile systems. All radar fuzes utilized by Army missiles were investigated in respect to ECM vulnerability. Selected systems and components were studied. Techniques were developed for the detection, tracking, and identification of missiles. ECM vulnerability analyses of Improved HAWK, Improved NIKE-HERCULES, REDEYE, CHAPARRAL and PATRIOT were conducted. Vulnerability of SAFEGUARD Ballistic Missile Defense System to ECM was studied. Techniques for the protection of armor from enemy antitank missiles were studied. Infrared signatures of Army aircraft were taken. Initiated the development of for a tactical radio anti-jam system. A Radar Target Radio Communication system; and a semiautomatic missile vulnerability studies. Extensive testing of the HOTBRICK (an active infrared missile jammer) was conducted. Program planning was accomplished for Improved HAWK system capability against conducted to determine electronic counter-measures (ECM) for the improved high power illuminator radar (IHPIR). Short range air defense systems (SHORADS) susceptibility/vulnerability analysis continued. The HOTBRICK infrared missile jammer analysis was completed. Support to the Tri-service electro-optics weapons vulnerability/susceptibility test programs continued. Contracts for a phased study of PATRIOT susceptibility and for PATRIOT jammers were let. The BIG CROW flying electronic warfare laboratory completed flight certification tests and participated in active missions at White Sands Missile Range to verify equipment operation. Infrared countermeasures studies of the STINGER missile were initiated. Work was initiated on the US ROLAND (Short Range Air Defense System). A study of Electronic Counter-Countermeasure investigations of Avionics, Ground Communications and Automatic Data Processing, and Surveillance, Target Acquisition and Night observation systems continued. Measurement and analysis of the signatures of Army aircraft with infrared suppression equipment installed were conducted. An analysis of the PATRIOT electronic counter-countermeasure specifications was conducted. Contracts were let for a study of PATRIOT, Investigation of other US Air Defense weapons and upgrade of facilities to support these investigations were continued. A field investigation of three different air defense missile systems was conducted in the Special Electromagnetic Interferences (SEMI) task. Results of the effects of on the Improved HAWK were reported and electronic counter-countermeasures recommendations provided. Contracts in support of SEMI, PATRIOT and the susceptibility program were awarded.



Budget Activity #4 - Tactical Programs

Program Element #6.37.18.A

Title Electronic Warfare Vulnerability/Susceptibility

2. FY 1977 Program: Support of the Tri-Service Electro-optics Vulnerability/Susceptibility Test Program will continue. Vulnerability analysis of all current and proposed US Antitank systems will continue. Tri-service work on the exploitation of foreign missile systems will continue. Field investigation of current and proposed missile fuze systems will be performed. PATRIOT missile support will continue. Project SEMI will examine two additional and initiate a field firing program of five missile systems. Support to major communications systems, navigation systems, and radar systems will continue.
3. FY 1978 Planned Program: Support to the Tri-Service Electro-optics vulnerability/susceptibility test program will continue. Tri-Service work on support to missile fuze systems, special Electromagnetic Interference (SEMI), will continue. Additional funds will accelerate support to PATRIOT air defense missile system test program/ additional BIG CROW support, additional jammer fabrication, additional analysis effort. Support to major non-missile electronics systems, delayed by inadequate funding in prior years, will be accelerated.
4. FY 1979 Planned Program: Additional funds will accelerate vulnerability/susceptibility analyses of non-missile electronics systems (avionics systems, surveillance and night vision systems, communications and data processing systems); will continue accelerated support to developmental/operational tests of PATRIOT air defense missile systems; will increase support to other air defense missile systems (ROLAND, Improved HAWK, STINGER); will increase support to antitank guided missile systems. Jammers, field test instrumentation equipment, and other hardware to provide electronic warfare environment for field tests must be fabricated and procured. Project SEMI evaluation will continue.
5. Program to Completion: This is a continuing program. Efforts will be directed toward assuring the functional survivability of US electronics systems in an electronic countermeasure environment.
6. Major Milestones: Not Applicable.



FY 1978 RDT&E DESCRIPTIVE SUMMARY

|                 |                      |                 |   |
|-----------------|----------------------|-----------------|---|
| Program Element | #6.37.18.A           | Title           | Electronic Warfare Vulnerability/Susceptibility |
| Project         | #D267                | Title           | Missile Vulnerability/Susceptibility            |
| Category        | Advanced Development | Budget Activity | #4 - Tactical Programs                          |

**BACKGROUND AND DESCRIPTION:** The objective of this project is to determine the susceptibility to electronic countermeasures (ECM) of all US Army surface-to-air missile systems; determine the ECM vulnerability of enemy tactical missiles that are a threat to the tactical commander; develop prototype electronic warfare systems to [and provide to US Army missile developers recommendations for electronic counter-countermeasures (ECCM) circuits and devices that will reduce the vulnerability of our missile systems to enemy electronic warfare operations.

**RELATED ACTIVITIES:** Other related research and studies are performed by the Air Force and Navy. Coordination is accomplished by reviews conducted by the Office of the Secretary of Defense (Director Defense Research and Engineering), through the exchange of technical reports and attendance at scientific meetings and conferences. A joint Army, Navy, Air Force, and Marine Corps project for electro-optically guided weapons countermeasures test is being conducted under a program funded by the Director of Defense Research and Engineering. The Army is Executive Agent for this program.

**WORK PERFORMED BY:** In-house research, development, exploitation, and missile system susceptibility analyses are conducted by the Office of Missile Electronic Warfare, Electronic Warfare Laboratory, White Sands, New Mexico. Major contractor support is provided by GTE, Sylvania, Mountain View, California; Cincinnati Electronics Corporation, Cincinnati, Ohio; AVCO, Wilmington, Massachusetts; New Mexico State University, Las Cruces, New Mexico; and General Dynamics, Fort Worth, Texas.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Electronic Countermeasures (ECM) vulnerability studies were conducted on PERSHING, SERGEANT, LANCE, NIKE-HERCULES, HONEST JOHN, CORPORAL, SHILLELAGH, DRAGON, and TOW missile systems. All radar fuzes utilized by Army missiles were investigated in respect to ECM vulnerability. Selected systems and components were studied. Techniques were developed for the detection, tracking, and identification of missiles. ECM vulnerability analysis of Improved HAWK, Improved NIKE-HERCULES, REDEYE, CHAPARRAL, and PATRIOT were conducted. Techniques for the protection of armor from enemy antitank missiles were studied. Extensive testing was conducted on an infrared seeking anti-aircraft missile system countermeasures device (HOT BRICK). Exploitation of the [and the

Budget Activity #4 - Tactical Programs

Program Element #6.37.18.A

Project #D267

Title Electronic Warfare Vulnerability/Susceptibility

Title Missile Vulnerability/Susceptibility

were conducted. Assistance was provided to the Short Range Air Defense (SHORAD) study group in preliminary efforts to determine Army technical and operational requirements and electronic warfare analysis of selected weapons. Static and dynamic field tests were performed on the DRAGON missile system. Field investigations were conducted with al against the TOW and DRAGON missile systems. Preliminary vulnerability investigations were completed on the LANCE fuze system. Studies were continued on systems. Field investigations were conducted to determine electronic counter-measures (ECCM) for the improved high power illuminator radar (IHPIR). SHORAD susceptibility/vulnerability analysis continued. Contracts for a phased study of PATRIOT Susceptibility and for PATRIOT jammers were let. The BIG CROW flying electronic warfare laboratory completed flight certification tests and participated in active missions at White Sands Missile Range to verify equipment operation. Infrared countermeasure studies of the STINGER Missile Systems were initiated. Work was initiated on the ROLAND (Short Range Air Defense System). A study of was completed. Measurement and analysis of the signatures of Army aircraft with infrared suppression equipment installed were conducted. An analysis of the PATRIOT electronic counter-measure specifications was conducted. Contracts were let to study PATRIOT Investigation of other US Air Defense weapons and upgrade of facilities to support these investigations continued. A field investigation of three different air defense missile systems was conducted in the Special Electromagnetic Interference (SEMI) task. Results of the effects of on the Improved HAWK were reported and electronic counter-measure recommendations provided.

2. FY 1977 Program: Support of the Tri-service Electro-optics Vulnerability/Susceptibility Test Program continues. Vulnerability analysis of all current and proposed US Antitank systems will continue. Tri-service work on the systems will continue. Field investigation of current and proposed missile fuze systems will be performed. The PATRIOT vulnerability investigation will proceed into field testing. Project SEMI will examine two additional systems, and initiate a field firing program of five missile systems.

3. FY 1978 Planned Program: Tri-service work in exploitation of foreign missile systems, support to missile fuze systems, special electro-magnetic interference (SEMI) program will continue. Additional funds will accelerate support to PATRIOT air defense missile system test program (greatly increased BIG CROW flying electronic warfare laboratory support, fabrication of jammers for PATRIOT Developmental tests, additional analysis effort).

4. FY 1979 Planned Program: Developmental/operational test support for PATRIOT air defense missile system will continue to be accelerated, other air defense missile system developmental tests will be accelerated (ROLAND, Improved HAWK, STINGER), hardware to support other air defense missile systems will be fabricated, test instrumentation equipment will be obtained, Project SEMI studies will continue, support to nine other tasks (e.g., missile detection and tracking techniques, antitank missile systems, foreign missile systems, fuze investigations, etc.) will continue.

Budget Activity #4 - Tactical Programs

Program Element #6.37.18.A

Project #D267

Title Electronic Warfare Vulnerability/Susceptibility

Title Missile Vulnerability/Susceptibility

5. Program to Completion: This is a continuing program. Efforts will be directed toward assuring the functional survivability of US missile systems in an electronic countermeasure environment.

6. Major Milestones: Not Applicable.

RESOURCES: (\$ in Thousands)

|             | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost | Not Applicable |
|-------------|---------|---------|---------|---------|--------------------------------|----------------------------|----------------|
| RDTE: Funds | [       | -       | -       | -       | -                              | -                          | -              |

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.37.18.A

Title Electronic Warfare Vulnerability/Susceptibility

Project #D626

Title Non-Missile Vulnerability/Susceptibility

Category Advanced Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to provide Army commanders, laboratories, and project/product managers with timely electronic warfare susceptibility/vulnerability assessments of their communications - electronics systems, less missiles, as well as recommending and developing appropriate electronics counter-countermeasures (ECCM) techniques.

RELATED ACTIVITIES: Other related research and studies are performed by the Air Force and Navy. Coordination is accomplished by reviews conducted by the Office of the Secretary of Defense (Director, Defense Research and Engineering), through the exchange of technical reports and attendance at scientific meetings and conferences.

WORK PERFORMED BY: In-house research, development and communications-electronics (C-E) system vulnerability/ECCM analysis are conducted by the US Army Electronic Research and Development Command (ERADCOM), Fort Monmouth, New Jersey. Major contractor support is provided by Rockwell International, Anaheim, California; Hazeltine Corporation, Greenlawn, New York; American Electronic Laboratories Inc., Lansdale Pennsylvania; Computer Sciences Corporation, Falls Church, Virginia; and Echo Sciences Corporation, Mountain View, California.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Continued efforts to determine electronic warfare (EW) vulnerability and develop ECCM requirements for a variety of aviation electronics systems; continued efforts to furnish vulnerability/ECCM support to program managers for navigation systems; continued efforts to evaluate application of automatic steerable null antenna processors to communications systems. Completed EW vulnerability assessment of XM1 and M60 tank communications. Conducted performance tests on equipments for communications. Completed vulnerability analysis and preliminary EW field tests on AN/TPQ-37 (artillery locating radar) and AN/TPQ-36 (mortar locating radar). Initiated vulnerability analysis of



Budget Activity #4 - Tactical Programs

Program Element #6.37.18.A

Title Electronic Warfare Vulnerability/Susceptibility

Project #D626

Title Non-Missile Vulnerability/Susceptibility

Stand-Off Target Acquisition System (SOTAS), initiated vulnerability/electronic counter-countermeasures (ECCM) assessments of Advanced Attack Helicopter (AAH), Utility Transport Helicopter (UTAS), and Advanced Scout Helicopter (ASH). Continued vulnerability analysis of Army Communications systems such as Tactical Fire Direction System (TACFIRE), Tactical Operations System (TOS), AN/TSQ-73, Joint Service Communications Program (TRI-TAC), Single Channel Ground and Airborne Radio System (SINCGARS). Performed analysis of effects of on weapon locating radars.

2. FY 1977 Program: Continue tasks initiated in prior years. Complete XML tank and ASH vulnerability assessment. Initiate Electronic Warfare (EW) vulnerability assessments on Mechanized Infantry Combat Vehicle (MICV) and Remotely Piloted Vehicle (RPV). Identify EW vulnerability of Joint Tactical Information Distributing System (JTIDS). Complete Doppler Navigation electronic warfare field tests. Complete interim Steerable Null Antenna Processor (SNAP) models for tactical communications systems.

3. FY 1978 Planned Program: Additional funds will accelerate tasks initiated in prior years. Develop systems vulnerability assessment model. Identify ECCM requirements for XML tank systems and Advanced Scout Helicopter (ASH). Complete vulnerability assessment of MICV. Accelerate Position Locating Reporting System (PLRS) and Joint Tactical Information Distribution System (JTIDS) vulnerability evaluation. Support PLRS field tests.

4. FY 1979 Planned Program: Increase in funds will accelerate vulnerability assessments and ECCM development of major Army communications systems (SINCGARS, TOS, TACFIRE, AN/TSQ-73, TRI-TAC) to meet systems development schedules and expand.

Investigate laser rangefinder vulnerability, night vision system vulnerability, determine and evaluate optical counter-countermeasures. Accelerate support to target locating radar systems and ECCM development for Stand-off Target Acquisition System.

5. Program to Completion: This is a continuing program. Efforts will be directed toward assuring the functional survivability of US Communications Electronics Equipment (less missiles) in an electronic countermeasure environment.





FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.22.A Title Tactical Operations System (TOS)

Category Advanced Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| <u>Project Number</u> | <u>Title</u><br><u>TOTAL FOR PROGRAM ELEMENT</u><br><u>Quantities 1/</u> | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | Additional to Completion Continuing | Total Estimated Cost |
|-----------------------|--|----------------|----------------|----------------|----------------|-------------------------------------|----------------------|
|                       |  | <u>4300</u>    | <u>706</u>     | <u>6777</u>    | <u>11939</u>   |                                     |                      |
| D494                  | Tactical Operations System   | 4300           | 706            | 6777           | 11939          | Continuing                          | Not Applicable       |

BRIEF DESCRIPTION OF ELEMENT: The Tactical Operations System (TOS) is a division level computer assisted command and control system to increase significantly the capability of ground combat commanders and their staffs to manage the employment of Army combat power.

BASIS FOR FY 1978 RDTE REQUEST: Complete necessary technical, logistical and cost analyses to validate a TOS concept and prepare for Defense Systems Acquisition Review Council (DSARC) II decision point to enter engineering development in early FY 1978. In order to procure a TOS engineering development prototype, new contractual efforts for hardware development, maintenance and support services, and overhaul/repair support and continued contractual software development will be required.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: During FY 1977, concept validation testing with the TOS Operable Segment (TOS<sup>2</sup>) will be completed and preparation for the DSARC II decision point will be initiated. In early FY 1978, the DSARC II decision point will be held, and the plan to enter engineering development will be implemented. This will require new contractual arrangements for hardware development, maintenance and support services, and overhaul/repair support and continued contractual efforts for software development.

1/ Various hardware items have been developed and procured for the TOS Operable Segment (TOS<sup>2</sup>) representing a portion of a full division TOS. Exact quantities of equipment required for a full division will be definitized after TOS<sup>2</sup> testing and COEA analysis and presented to DSARC II.

Budget Activity #4 - Tactical Programs

Program Element #6.37.22.A

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (ROUTE and Procurement), is as follows:

Title Tactical Operations System (TOS)

TERMINATION COST: (\$ in Thousands)

|                            | ROUTE | PROCUREMENT | TOTAL | FY 1977<br>and<br>Prior | FY 1978 | Total  |
|----------------------------|-------|-------------|-------|-------------------------|---------|--------|
| (1) Federal Civ. Employees | 40    | 0           | 40    |                         |         |        |
| (2) Contractor Employees   | 98    | 0           | 98    |                         |         |        |
| Total                      | 138   | 0           | 138   | 42,993                  | 633     | 43,626 |

(1) Estimated Government Liability  
Financed with:

**DETAILED BACKGROUND AND DESCRIPTION:** TOS will constitute an on-line, near real-time, automatic data processing (ADP) system which will provide an improved capability at division level to receive, process, store, retrieve, display and disseminate selected information required by commanders and their staffs for decision making. Specific objectives are to provide a system to improve command and control capabilities, reduce reaction time, integrate fire support and maneuver, improve operational and decision-making capabilities, provide enhanced capability for use of operations and intelligence data, and improve the speed and accuracy of plans and estimates. Initial efforts in the TOS program have been devoted to development of TOS Operable Segment (TOS<sup>2</sup>). The TOS<sup>2</sup> hardware constitutes an austere test bed of militarized equipments automating a slice of a division command and control system.

**RELATED ACTIVITIES:** The TOS<sup>2</sup> is primarily made up of equipment which is common to that already developed under the Tactical Fire Direction System (TACFIRE) program, PE 2.37.26.A, D322. The TOS system will interface with other systems such as TACFIRE and the Air Defense Command and Control System AN/TSQ-73, PE 6.43.02.A, D233. Efforts in this program element also have application to developments in Project D101, PE 6.37.23.A, Integration of Army Tactical Data Systems Program, and in Project 654, PE 6.37.03.A, Automatic Data Processing Development. This latter project was previously funded in Program Element 6.37.23 in portions of FY 1972 and FY 1973 and in Program Element 6.47.23.A in FY 1971, under the title of Tactical Automatic Data Processing System Equipment. Continual liaison is conducted at laboratory level and by the Project Manager with developers of automated systems in other services to preclude duplication of effort. In addition, there are numerous tri-service working groups which ensure a continual dialogue between systems developers.

**WORK PERFORMED BY:** Overall coordination is provided by the Project Manager for Army Tactical Data System (PM ARTADS) USA Electronics Command (ERADCOM) located at Fort Monmouth, New Jersey. Contractual efforts are being performed by Litton Industries, Incorporated, Van Nuys, California; Auerbach Associates, Incorporated, Philadelphia, Pennsylvania; and Systems Development Corporation, McLean, Virginia.

Budget Activity #4 - Tactical Programs

Program Element #6.37.22.A

Title Tactical Operations System (TOS)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments:

During the period 1964-1969, the Army developed an experimental TOS in Europe under the direction of US Army Europe (USAREUR/7th Army) using commercial equipment and contractual personnel to evaluate the feasibility and desirability of the TOS concept at Field Army and Corps levels. These experiments became known as EUROTOS. Based on results from these tests, the Army directed its efforts toward the development of a system for the division and its subordinate units. In 1970, hardware and software packages were moved from Europe to Fort Hood, Texas, and the experimental system was renamed the Development TOS (DEVTOS). In February 1972, DA approved the TOS Systems Engineering Study (SES) which defined the hardware and software specifications for the TOS<sup>2</sup> test bed and authorized the procurement of TACFIRE hardware to satisfy the test bed hardware requirements. It was also determined that although TACFIRE hardware purchased for TOS<sup>2</sup> could be considered Engineering Development (ED) equipment, the software was not developed and the program would be more accurately described as Advanced Development. At the time of the SES approval, the Army further decided that the TOS<sup>2</sup> software would be developed in-house by the US Army Computer Systems Command (USACSC). The software effort began in February 1972, and the TOS<sup>2</sup> hardware contract was awarded to Litton Industries in June 1972. The TOS Development Concept Paper (DCP) was approved by the Office of the Secretary of Defense in September 1972. The FY 1973 effort was devoted to the TOS<sup>2</sup> hardware fabrication and software development. In June 1973, the first increment of the TOS<sup>2</sup> hardware for Software Support System (SSS) was delivered on schedule. In FY 1974, the major effort continued to be the area of software development and completion of the hardware development contract. In August 1973, Director of Defense Research and Engineering was notified of an anticipated 9 month slippage of the software acceptance milestone and a potential 3 month breach of the DCP schedule thresholds. A program review resulted in a revised milestone schedule which slipped the program 9 months and a revised funding profile, which increased Phase I costs but kept the total RDTE cost estimate constant. A revised DCP was approved in June 1974. In October 1974, the TOS<sup>2</sup> hardware delivery was completed and accepted by Project Manager, Army Tactical Data Systems (PM ARTADS) at Fort Hood. Also in October 1974, the Army reevaluated the USACSC capability to complete the design and production of the TOS<sup>2</sup> software. This resulted in a 3 year contract for software development assistance to Auerbach Associates, Incorporated. Software development continued throughout FY 1975.

The major thrust of FY 1976 was to continue TOS<sup>2</sup> development and hardware integration. In February 1976, Field Test FM 120 (FDTE) was initiated. However, it was suspended in April 1976 due to software problems (see Test and Evaluation Section). Following the suspension, the major emphasis during the July-September 1976 time frame has been to improve the TOS<sup>2</sup> software package in preparation for software/hardware integration testing for conducting Test FM 222 (Development Test/Operational Test I (DT/OT I)) during FY 1977. Additionally, the TOS<sup>2</sup> test bed and facilities at Fort Hood were utilized to conduct system experimentation in a workshop environment.

2. FY 1977 Program: Continue TOS<sup>2</sup> software development and hardware integration, conduct field testing (DT/OT I), validate a TOS concept, conduct COEA and related analyses and prepare for DSARC II currently scheduled for January 1978.



Budget Activity #4 - Tactical Programs

Program Element #6.37.22.A

Title Tactical Operations System (TOS)

3. FY 1978 Planned Program: Conduct the DSARC II decision point and implement the plan to enter into a full scale development program designed to procure a TOS engineering development prototype. All necessary experimental work has been performed and the proposed system is ready for full scale development. Procurement packages for hardware and software will be completed and contracts will be awarded. The increase in FY 1978 funding reflects the entrance into the Full Scale Development phase.
4. FY 1979 Planned Program: Continue the engineering development of the TOS prototype. This includes contractual hardware development, hardware maintenance and support services, overhaul/repair support and software development. The significant increase in FY 1979 over FY 1978 is to fund the level of effort required to complete the prototype development and to prepare for and conduct Development Test/Operational Test (DT/OT) II to meet an early 1981 fielding milestone.
5. Program to Completion: The TOS development program is being conducted in three phases as outlined in the approved Decision Coordinating Paper (DCP). Phase I extending through Defense Systems Acquisition Review Council (DSARC) II involves development, test and validation of the TOS concept in an operational environment. Phase II consists of engineering development of a division TOS prototype based upon a DSARC II decision. Depending on the procurement option chosen for the engineering development, Phase II will be completed in the FY 1981 time frame. Phase III is the fielding of the division level TOS.

6. Major Milestones:

|                                      | <u>Date</u> | <u>Estimated RDTE Cost to<br/>Reach Events (Cumulative)<br/>(\$ in Millions)</u> |
|--------------------------------------|-------------|--|
| a. Hardware Contract Award           | Jun 72      | 11.7   |
| b. Software Support System Delivered | Jun 73      | 20.1   |
| c. Hardware Acceptance               | Oct 74      | 29.2   |
| d. Software Acceptance               | Nov 76      | 38.6   |
| e. Field Tests (DT/OT I) Begin       | Mar 77      | 40.7   |
| f. Field Tests Completed             | Jul 77      | 41.8   |
| g. DSARC II                          | Jan 78      | 42.8   |



Budget Activity #4 - Tactical Programs

Program Element # 6.37.22.A

Title: Tactical Operations System (TOS)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: The development contractors for the Tactical Operations Systems Operable Segment (TOS<sup>2</sup>) are Litton Data Systems of Van Nuys, California (hardware) and Auerbach Associates of Philadelphia, Pennsylvania (software). TOS is being evaluated and validated using the TOS<sup>2</sup> militarized test bed which is composed mainly of hardware that was developed for the Tactical Fire Direction System (TACFIRE). The TOS<sup>2</sup> equipment will be configured to permit testing of the preferred automatic data processing (ADP) alternative configuration in the validation of a TOS concept and definitize the TOS engineering development requirements.

The initial field test, FM 120, was conducted during Mar-Apr 76. It had to be suspended due to problems encountered with the TOS<sup>2</sup> software functional capability, i.e., reliability, throughput, recovery process, and human interface. Although several attempts were made to fix the software, a satisfactory system could not be achieved and FM 120 had to be suspended. While the test objectives were not achieved, valuable data were derived for use in the cost and operational effectiveness analysis performance models and evaluation of the ADP configuration alternatives for subsequent testing. Since the termination of FM 120, the TOS<sup>2</sup> software package has been thoroughly assessed and corrections/improvements have been incorporated. The software package has been tested by the contractor using the facilities at the software support center and at Ft Hood using the TOS<sup>2</sup> test bed hardware. Final qualification testing (FQT) for test FM 222 was conducted by the Government during the period Sep-Nov 76.

FQT indicated that the TOS<sup>2</sup> software package will be ready for FM 222, a combined Force Development Test and Experimentation/Developmental Test I/Operational Test I, which is scheduled for the Apr-Jul 77 timeframe. The test will be conducted by the US Army Training and Doctrine Command's Combined Arms Test Activity using III Corps troop units at Ft Hood and has the following objectives:

- a. Allow an assessment of the capability of the TOS<sup>2</sup> to support the commander and staff in planning and operations to accomplish the mission.
- b. Permit identification of hardware and software requirements and refinement for TOS<sup>2</sup> to become a division TOS.
- c. Allow an assessment of the capability of tactical communication means to support TOS<sup>2</sup>.
- d. Permit assessment of the training requirements necessary for the division to employ TOS<sup>2</sup>.
- e. Demonstrate TOS<sup>2</sup> and TACFIRE interoperability.

US Army Materiel Systems Analysis Agency will participate in the FM 222 testing and will provide Army Systems Acquisition Review Council/Defense Systems Acquisition Review Council II with an independent development test evaluation.

Budget Activity #4 - Tactical Programs

Program Element #6.37.22.A

Title: Tactical Operations System (TOS)

2. Operational Test and Evaluation: US Army Operational Test and Evaluation Agency (OTEA) will manage FM 222 testing and evaluation of TOS using the TOS Operable Segment (TOS<sup>2</sup>) and provide Army System Acquisition Review Council/Defense Systems Acquisition Review Council (ASARC/DSARC) II with an independent Operational Test evaluation. FM 222 will provide the means to test and evaluate the preferred alternative and provide data for the TOS cost and operational effectiveness analysis. Plans for additional testing will be heavily influenced by the degree of similarity between tested representation of the system using TOS<sup>2</sup> and the engineering development configuration approved by the ASARC/DSARC II. Developmental Test/Operational Test II is scheduled for the FY 1980 timeframe.

3. System Characteristics:

Objectives 1/ Demonstrated 2/

a. Operational

Total System Reliability

.950

Computer Center Reliability

.923

Displacement/Set Up Time

20 min

1/ Based on the TOS Material Need (MN), Nov 1972

2/ To be demonstrated during Development and Operational Testing

# FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.26.A

Title Combat Support Equipment

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                               | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Total          |                |
|----------------|-------------------------------------|---------|---------|---------|---------|----------------|----------------|
|                |                                     |         |         |         |         | Estimated Cost | Not Applicable |
|                | TOTAL FOR PROGRAM ELEMENT           | 4,817   | 1,512   | 3,464   | 10,429  |                |                |
| DG01           | Combat Engineer Equipment           | 1,060   | 293     | 1,394   | 4,001   | Continuing     | Not Applicable |
| DG14           | Container Distribution Equipment    | 685     | 190     | 354     | 803     | Continuing     | Not Applicable |
| DK39           | General Support Equipment           | 272     | 120     | 364     | 1,007   | Continuing     | Not Applicable |
| DK41           | POL Distribution Systems            | 436     | 115     | 290     | 517     | Continuing     | Not Applicable |
| D471           | Camouflage                          | 2,069   | 445     | 878     | 2,496   | Continuing     | Not Applicable |
| D526           | Marine Oriented Logistics Equipment | 295     | 349     | 184     | 1,605   | Continuing     | Not Applicable |

BRIEF DESCRIPTION OF ELEMENT: This program element supports advanced development (AD) of: combat engineer equipment; containerized supply distribution equipment; heating, air conditioning and water purification equipment; fuels handling material; camouflage techniques and equipment; and marine-oriented logistics support items.

BASIS FOR FY 1978 RDTE REQUEST: Complete AD of cargo container insert, flatrack container, sectionalized barges, and a water purification unit. Conduct AD of: components for new tactical bridging and related access/egress problems; improved containerized ammunition restraint, container identification system, air-levitated materials handling, and container environmental control; combined heater/air conditioner system; components for improved water purification system; new fabric fuel storage tank and low temperature fueling system; built-in camouflage, decoys, reflectors, and camouflage of combat units, moving targets; and alternatives for 60-ton logistics amphibian.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Decrease is primarily net result of decreased thrust is camouflage activities offset partially by increased funding requirements to support advanced bridging concept efforts.

## PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

Budget Activity #4 - Tactical Programs

Program Element #6.37.26.A

Title Combat Support Equipment

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 100  | 0           | 100   |
| (2) Contractor Employees   | 7    | 0           | 7     |
| Total                      | 107  | 0           | 107   |

DETAILED BACKGROUND AND DESCRIPTION: Elimination of identified deficiencies in combat support is required by developing new and more efficient capabilities to include: family of bridging to reduce installation time and manpower; rapidly-built bridge access/egress; equipment for handling containerized and bulk supplies; fuel distribution; logistics support marine items; tactical heating/air conditioning; water purification of sea/brackish water in arid areas; and camouflage, simulation, and decoy systems to negate surveillance threats.

RELATED ACTIVITIES: Coordination to avoid duplication and program guidance is accomplished through trilateral US/UK/FRG agreement and Steering Committee for Bridging in the 1980's; Department of Defense (DOD) Logistics Systems Policy Committee; Joint Container Steering Group; and Project Manager for Army Container-Oriented Distribution System. Related exploratory development is in Program Element (PE) 6.27.33.A, Mobility Equipment Technology. Items in this PE progress to engineering development in PE 6.47.17.A, General Combat Support.

WORK PERFORMED BY: In-house efforts are performed by the U.S. Army Mobility Equipment Research and Development Command, Fort Belvoir, VA; and the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. Contractors include Pacific Car and Foundry, Seattle, WA; General Dynamics, San Diego, CA; Brunswick Corporation, Deland, FL; National Foam Corporation, Lionsville, PA; Devils Lake Sioux Manufacturing Corporation, Fort Totten, SD; WELCO Industries, Cincinnati, OH; Unitron, Incorporated, Garland, TX; Value Engineering Company, Alexandria, VA; Fairchild Industries, Incorporated, Germantown, MD; Copco Steel and Engineering Company, Anderson, IN; and nine additional or planned contracts totaling \$500,000.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Established trilateral program for bridging in the 80's, and began efforts on bridge components. Investigated various items for handling containerized cargo to include flatracks, spreader bars, container inserts, restraint kits, container identification system, and electronic labeling. Completed advanced development (AD) of 250,000 British Thermal Unit/Hour (BTUH) heater, and 600 and 1,500 gallons per hour (GPH) Reverse Osmosis Water Purification Units (ROWPU). Completed investigations of various fuel transport means, a fuel tagging kit, and electrokinetic fuel decontamination. Began cost study of fuel transport alternatives and design of 10,000 barrel fabric storage tank. Proved feasibility of smoke screen camouflage. Continued camouflage support for various weapons systems. Completed pattern painting criteria, design of disruptor, and analysis of NATO missile site camouflage test. Continued efforts to reduce thermal and radar signatures, develop



**Budget Activity #4 - Tactical Programs**

**Program Element #6.37.26.A**

**Title Combat Support Equipment**

camouflage data base, develop low-cost decoys, and study low-profile antennae. Studied various watercraft concepts for Army logistics support. Began fabrication of modules for a rapidly-deployable sectionalized barge.

2. **FY 1977 Program:** Initiate designs/fabrication of components for wheeled-vehicle launched bridge. Start bridge access/egress efforts. Complete advanced development (AD) of structural type container restraint kit and container identification system. Evaluate container inserts, flatracks, air cushion cargo-moving device, and low-cost electronic label. Initiate AD of advanced type ammunition restraint, container insulation, and a joint Army/Navy effort on a beach container transporter. Continue AD of 18,000 British Thermal Unit/Hour (BTUH) Total Environmental Control System (TECS-18). Procure and test components of high-pressure pump, filters, and chemical feeders for dry membrane Reverse Osmosis Water Purification Unit (ROWPU). Initiate concept studies for 3,000 gallons per hour (GPH) ROWPU. Complete field transport study, begin design of 10,000 barrel fabric fuel tank, and procure components for low temperature refueling system. Evaluate prototype camouflage decoys, thermal attenuators, foam obscuration, and means to reduce missile signatures. Analyze signatures of a field artillery unit and moving targets. Complete fabrication of sectionalized barge modules. Participate in joint Army/Navy logistics-over-the-shore (LOTS) test.
3. **FY 1978 Planned Program:** Procure and test bridge launchers and dry gap spans. Finalize best interim solutions to bridge access/egress problem. Complete AD of container insert and flatrack. Procure prototype prestage load ammunition restraint. Conduct joint test with Navy of beach container transporter. Assess results of container insulation and air-cushion cargo movement tests. Continue AD of TECS-18. Complete concept formulation of 3,000 GPH ROWPU. Procure prototype 10,000 barrel fabric fuel storage tank and start test. Conduct test of low temperature refueling system. Continue evaluations of prototype camouflage hardware. Develop camouflage applications for a field artillery unit, and develop hardware concepts for measuring camouflage effectiveness for tactical moving targets. Test rapidly-deployable sectionalized barge system. Analyze results of joint LOTS test. Initiate study of alternatives and develop characteristics for 60 ton high-speed logistics amphibian.
4. **FY 1979 Planned Program:** Selected approaches for bridging will enter engineering development, and applicable AD will continue in cooperative program with UK and FRG. Long range solution to bridge access/egress problem will be pursued, and evaluations made of composite materials for final bridge designs. Continue AD on various containerized cargo handling items. Complete tests of TECS-18. Initiate AD of family of electric heaters, other capacity TECS, and air-cycle environmental control system. Test ultra-filters for ROWPU's and non-chlorinating water disinfection. Complete AD of low temperature refueling, continue work on fabric storage tank, and begin AD on a marine terminal fuel filter separator. Continue camouflage AD with emphasis on built-in systems, providing Army-wide assistance, reducing weapons vulnerability, analyzing field unit signatures, foam obscuration, dynamic targets, fixed installations, and evaluating various prototype hardware. Complete AD on sectionalized barge, and systems definition for 60 ton logistics amphibian. Begin AD of rapidly deployed port modules, and on other capability deficiencies identified in the joint LOTS test. Increase in FY 1979 funding is necessary to achieve required capabilities in bridging, improved logistics cargo and fuel resupply, countersurveillance measures, and efficient heaters, air conditioning, and water purification.
5. **Program to Completion:** This is a continuing program.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element # 6.37.26.A

Title Combat Support Equipment

Project # DC01

Title Combat Engineer Equipment

Category Advanced Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: This project consists of the development of a family of bridging for the 1980's and related solutions for the access/egress problems associated with river crossings. The bridging development is being pursued with United Kingdom (UK) and Federal Republic of Germany (FRG) cooperation. Substantial essential improvements over current bridging assets are anticipated through reductions in installation time and manpower required for assault, wet, and dry gap crossing. Access/egress solutions are being sought with new general purpose mats/panels and new techniques with locally available and other materials.

RELATED ACTIVITIES: There is no effort by other Services to develop like equipment. The Army maintains coordination with the US Marine Corps and Navy concerning this project.

WORK PERFORMED BY: In-house efforts are performed by the US Army Mobility Equipment Research and Development Command, Fort Belvoir, VA; and the US Army Waterways Experiment Station, Vicksburg, MS. Contract efforts will be with Pacific Car and Foundry of Seattle, WA and General Dynamics of San Diego, CA. Guidance and tasks are received from the US, UK and FMS Steering Committee for Bridging in the 1980's.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: As a result of an International Concepts Study Team (ICST) a family approach for military bridging was developed. This consisted of assault bridging and dry gap and wet gap bridging. A letter of agreement was approved and a tri-lateral program, entitled Bridging in the 1980's, was proposed with the US, UK, and FRG. A commercial chassis was procured for evaluation as a wheeled bridge transporter, design of a launching mechanism was initiated, a design and test code acceptable to the three countries was formulated, and a dry gap bridge concept was completed. Composite and advanced materials research was initiated for bridge components.
2. FY 1977 Program: A 30 meter bridge and 2 wheeled transporters will be fabricated. The design and fabrication of 2 launching mechanisms will be initiated and the design of a reinforcing system for a 52 meter dry gap support bridge will start. Study and analysis of suitable materials and approaches for access/egress problems will be initiated.
3. FY 1978 Planned Program: The two launching mechanisms will be procured. The design of the reinforcing system for this bridge will be completed. Bridge launching methods will be evaluated and results presented to the Steering Committee for Bridging in the 1980's. Hardware costs contribute to the increase over FY 1977. Short range access/egress solutions will be finalized.

Budget Activity #4 - Tactical Programs

Program Element # 6.37.26.A

Project # DG01

Title Combat Support Equipment

Title Combat Engineer Equipment

4. FY 1979 Planned Program: Selected approaches for Bridging for the 1980's will be moved into 6.4 Engineering Development. Applicable Advanced Development (AD) work remaining will be shared with the United Kingdom and Federal Republic of Germany. Long range solutions to access/egress problems will be designed, fabricated, and tested. Advanced composite materials for bridging components will be evaluated for use in the final bridge designs. Access/egress solutions contribute to the increase over FY 1978.

5. Program to Completion: This is a continuing program.

RESOURCES: (\$ in Thousands)

|  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|--|---------|---------|---------|---------|--------------------------------|----------------------------|
|  | 1060    | 293     | 1394    | 4001    | Continuing                     | Not Applicable             |

RDTE: Funds  
Quantities

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.30.A

Title Tactical Surveillance System

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT<br>Quantities | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost<br>Not Applicable Not Applicable |
|----------------|--|---------|---------|---------|---------|-------------------------------------|---|
| D560           | Tactical Surveillance System                     | -       | -       | -       | -       | Continuing                          | Not Applicable  |

BRIEF DESCRIPTION OF ELEMENT: This element supports the Advanced Development of a tactical support system to collect, process, and disseminate intelligence/information which locates and identifies enemy targets representing a general tactical threat. Advanced techniques are exploited in interfacing with a variety of strategic surveillance sensors and making the information available in the tactical command and control environment in a sufficiently timely and useful form to influence field operations.

BASIS FOR FY 1978 RDTE REQUEST: Completion of development of system interface specification with one collection sensor. Completion of development and installation of interface elements with collection sensors and the tactical command and control exploration capabilities. Initiation of total advanced development for exploratory one collector.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: This FY 78 effort continues effort initiated in FY 77. Increase of funding requirements reflects full implementation of system design and specifications defined in FY 77 effort.

Budget Activity #4 - Tactical Programs

Program Element #6.37.30.A

Title Tactical Surveillance System

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                           | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|---------------------------|-------------|--------------------|--------------|
| 1) Federal Civ. Employees | 8           | 0                  | 8            |
| 2) Contractor Employees   | 150         | 0                  | 150          |
| Total                     | 158         | 0                  | 158          |

**DETAILED BACKGROUND AND DESCRIPTION:** Data originating from a variety of tactical surveillance sensors is transmitted over short and long distances to collection points. Techniques and equipment are to be provided for expediting the collection of target acquisition information and for the rapid dissemination of tactical intelligence. Means of exploiting advanced techniques of data transmission will be developed to use information collected by tactical surveillance systems more effectively by making the information available in the command and control environment in a sufficiently timely and useful form to influence field operations.

**RELATED ACTIVITIES:** Technological developments designed to shorten the time required to collect and disseminate information are related to this development.

The equipment and techniques were addressed under 6.27.15.A, A448 Information System.

WORK PERFORMED BY: RCA Corp., Camden, NJ; Lockheed Missile and Space Co., Sunnyvale, CA; TRW, Los Angeles, CA; Aerospace Corp., El Segundo, CA; US Army Electronic Research and Development Command, Fort Monmouth, NJ; Electromagnetic Systems, Sunnyvale, CA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

FY 1977, FY 1976, and Prior Accomplishments: Studies were initiated to provide the technical base for the equipment and techniques for system design and development. In FY 1977 studies continued to provide the technical base for equipment and techniques for systems design and development. System interfaces specifications definition was initiated.

Budget Activity #4 - Tactical Programs

Program Element #6.37.30.A

Title Tactical Surveillance System

2. FY 1977 Program: System design studies to be completed. The completed systems design will be evaluated to determine whether the system will adversely impact any developments of the other Services. Initiate development and installation of interface elements. Systems interface specification definition completed.
3. FY 1978 Planned Program: The systems interface elements will be fully developed and installed. The system development for interface with one collection system will be initiated. Funding increase is required for implementation of system.
4. FY 1979 Planned Program: Advanced system development for interface with one collection will be completed and operational and developmental testing completed by program executive agent. Development of interface with other collections will continue.
5. Program to Completion: An advanced development level system for interface with one collection will be completed and tested in FY 79.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.37.A Title Anti-Radiation Missile Countermeasures (ARM/CM)

Category Advanced Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|--|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | TOTAL FOR PROGRAM ELEMENT              | 1200    | 205     | 3401    | 5042    |                                     |                                     |
| D181           | Anti-Radiation Missile Countermeasures | 1200    | 205     | 3401    | 5042    | Continuing                          | Not Applicable                      |

BRIEF DESCRIPTION OF ELEMENT: Develop technology for reducing vulnerability of ground-based emitters to attack by enemy anti-radiation missiles. Approach is to perform analysis, develop hardware prototypes and perform system testing to demonstrate effectiveness of a variety of countermeasure techniques. Effort addresses five areas of activity; threat evaluation and projection, countermeasures development, laboratory simulation and countermeasures testing, establish and maintain field test capability, develop and maintain a Tri-Service Anti-Radiation Missile Countermeasures (ARM/CM) data base.

BASIS FOR FY 1978 RDTE REQUEST: Continue laboratory simulation of generic ARM seekers (seekers which can be modified electronically to appear as any of several threat seekers), decoy development for counter battery radar, Tri-Service data base support, dual-mode (radar and infrared) decoys, field-test instrumentation; start analysis of communications terminal susceptibility, ground control approach radar susceptibility, determine impact of tactical scenario on decoy application, develop multipurpose modular decoys.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Increase in funds will accelerate simulation work begun in FY 1977, decoy developments, field tests instrumentation. Funds will also initiate development of ARM/CM for communications systems and radar systems other than air defense and artillery locating radars; develop multi-purpose modular decoy prototypes.

Budget Activity #4 - Tactical Programs

Program Element #6.37.37.A

Title Anti-Radiation Missile Countermeasures (ARM/CM)

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 39          | 0                  | 39           |
| (2) Contractor Employees   | 58          | 0                  | 58           |
| Total                      | 97          | 0                  | 97           |

DETAILED BACKGROUND AND DESCRIPTION: The Army has under development the Counter Battery Radar, AN/TPQ-37, and the Mortar Locating Radar, AN/TPQ-36, to provide a hostile weapons location capability and the Surface-to-Air Missile Developments (PATRIOT, HAWK, ROLAND) to provide the air defense surveillance, detection and target tracking capability.

RELATED ACTIVITIES: Development of anti-radiation missile countermeasures techniques will be conducted with the Army as the lead service. Countermeasures techniques developed under the Program Element will be utilized by anti-radiation missile countermeasures work done in Program Elements 6.43.07.A, SAM-D (PATRIOT), 2.37.31.A (SAM, HAWK, HAWK IMPROVEMENT), 6.43.09.A (ROLAND), 6.37.29.A (Counter Battery Radar). The Navy has conducted work in Program Element 6.35.16.N (Radar Surveillance Equipment), and the Air Force in Program Elements 6.37.18.F (Electronic Warfare Technology) and 6.37.50.F (Counter-Countermeasures Advanced Development). Information will be transferred between Services through the Tri-Service Joint Working Group on Anti-Radiation Missile Countermeasures and normal coordination among the Services.

WORK PERFORMED BY: The Army in-house developing organizations for this program are: Harry Diamond Laboratories, Adelphi, Maryland; US Army Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey; and US Army Missile Research and Development Command (MIRADCOM), Huntsville, Alabama. The Navy in-house developing organization for this program is Commander, Naval Sea Systems Command, Alexandria, Virginia, and Naval Weapons Center, China Lake, California. The Air Force in-house developing organization for this program is Rome Air Development Center, Griffiss Air Force Base, New York. Contractors are Analytix, Incorporated, Willow Grove, Pennsylvania; Computer Sciences Corporation, Huntsville, Alabama; General Dynamics, Pomona, California; Hughes Aircraft Corporation, Culver City, California; LTV Incorporated, St. Louis, Missouri; McDonnell-Douglas Corporation, Huntington Beach, California; Systems Planning Corporation, Arlington, Virginia.

Budget Activity #4 - Tactical Programs

Program Element #6.37.37.A

Title Anti-Radiation Missile Countermeasures (ARM/CM)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Program was a new start in FY 1976. A coordination office was established to supervise a review of prior work, provide direction to the Army program and leadership for the tri-service effort, and to prevent duplication of effort in hardware fabrication. Membership of a tri-service working group was established. Efforts were begun to identify solutions for each of the radars to which anti-radiation missiles are a threat, and to begin preparation of hardware specifications for anti-radiation missile countermeasures for the selected radars. Hardware specifications for anti-radiation missile countermeasures for each of the selected radars was completed and fabrication of the countermeasures was initiated. Applicability of these efforts to each service was identified.
2. FY 1977 Program: The technology base effort will be expanded. Tri-Service support will continue. Instrumentation to support field tests of the countermeasure developed for the various radars will be initiated. Multi-purpose modular decoy effort (common building blocks to make various radar decoys) will be initiated. Impact of tactical scenario on decoy applications effort will be initiated.
3. FY 1978 Planned Program: Increase in funds will permit acceleration of generic Anti-Radiation Missile seeker efforts (seeker which can be modified to appear electronically as any of several specific ARM seekers) and the instrumentation to support field testing. Design and analysis studies of communications terminal, ground control approach radars, and airborne radars susceptibilities will be initiated. Multi-purpose decoy brass board prototypes will be fabricated.
4. FY 1979 Planned Program: Increase in funds will permit completion of dual mode decoy prototypes, expansion of field test instrumentation to include aircraft configuration to fly against systems at various test facilities, support site signature measurements on various systems, begin countermeasure techniques for radar directed gun systems.
5. Program to Completion: This is a continuing program.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.40.A

Title Division Air Defense Command and Control System

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project<br>Number | Title   | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion<br>Continuing | Total<br>Estimated<br>Cost<br>Not Applicable<br>Not Applicable |
|-------------------|---|---------|---------|---------|---------|--|--|
| D593              | TOTAL FOR PROGRAM ELEMENT<br>Quantities<br>Divisional Air Defense<br>Command and Control System | 0       | 0       | 485     | 500     | Continuing                                   | Not Applicable   |

BRIEF DESCRIPTION OF ELEMENT: The objective of this program is to design, procure and test developmental models of a micro-miniaturized command and control system for divisional air defense gun and short range missile systems.

BASIS FOR FY 1978 RDTE REQUEST: A test bed will be developed and system specifications will be generated in preparation for engineering development.

BASIS FOR FY 1978 OVER 1977: Not applicable.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 3           | 0                  | 3            |
| (2) Contractor Employees   | 25          | 0                  | 25           |
| Total                      | 28          | 0                  | 28           |

Budget Activity #4 - Tactical Programs

Program Element #6.37.40.A

Title Divisional Air Defense Command and Control System

DETAILED BACKGROUND AND DESCRIPTION: This is a continuation of a new start initiated in FY 1977. The program is designed to provide an effective divisional command and control system which will insure operational integration of air defense guns and short range surface-to-air missiles (SAM) and to optimize the use of sensor data available in this environment. Proliferation of, and the growing sophistication of, divisional air defense weapons along with friendly and hostile users of the airspace compounds the need for an effective divisional air defense command and control system. This program will permit the exploitation of product improvements to existing equipments currently under development and validate the need for new equipment development efforts.

RELATED ACTIVITIES: Development of the AN/TSQ-73 Group/Battalion Level Command and Control System (P.E. 6.43.02.A Air Defense Control and Coordination System) and the Tactical Air Control Systems/Tactical Air Defense Systems (TAGS/TADS) test program (P.E. 6.47.12.A Joint Advanced Tactical C3P) designed to insure interoperability of the systems of all services. The Tactical Computer System (TCS) (P.E. 6.37.23.A Command and Control) and the Digital Message Device (DMD) (P.E. 2.37.26.A Tactical Fire Direction System) will be examined as potential candidates in the Divisional Air Defense Command and Control System. These actions are being coordinated with other Services at Project Manager and Service Lab levels to avoid possible duplicative development efforts.

WORK PREPARED BY: Overall coordination is provided by the Project Manager for Army Tactical Data Systems (ARTADS), located at USA Electronics Research & Development Command (ERADCOM), Fort Monmouth, New Jersey. Contractor assistance will be required.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Not applicable.
2. FY 1977 Program: Analyze available command and control equipments, air defense weapon systems and sensors (operational, product improvements, and those currently under development) in order to establish system loading, functional relationships and specific system functions to be performed as a basis for synthesizing viable equipment, configuration and operational employment relationships for effective divisional air defense command and control. The command and control of SHORAD weapons in the defense of critical rear area targets will be analyzed to determine if this task can be effectively performed by a divisional air defense command and control system and what if any adjunct equipment would be needed. The potential operational feasibility of candidate command and control configurations will be assessed, leading to the delineation of the relative advantages of each candidate judged to be highly cost effective. Critical functions, interfaces and equipment components identified in the configuration synthesis will be subject to verification testing to insure effective operational integration.
3. FY 1978 Planned Program: The early experimental verification facility will be expanded into a functional test bed to demonstrate integration and interoperability of all critical aspects of the defined divisional command and control system. Limited



Budget Activity #4 - Tactical Programs

Program Element #6.37.40.A

Title Divisional Air Defense Command and Control System

prototype models of identified critical new system components will be tested to validate the proposed divisional command and control system and cost versus requirement tradeoffs conducted. System specifications for the proposed divisional air defense command and control system/equipments will be generated, and a cost operational effectiveness analysis performed for candidate designs which span the range of requirements (austere to maximum capability).

4. FY 1979 Planned Program: Initiate procurement of Engineering Development system.
5. Program to Completion: Continue engineering development effort.

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|--|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities         |         |         |         |         |                                     |                                     |
| 0251           | Protective Electronic Warfare (EW) Equipment |         |         |         |         | Continuing                          | Not Applicable                      |
| 0905           | Division Tactical EW Systems                 |         |         |         |         | Continuing                          | Not Applicable                      |
| 0025           | Corps Tactical EW Systems                    |         |         |         |         | Continuing                          | Not Applicable                      |
| 0007           | Tactical Electronic Surveillance System      |         |         |         |         | Continuing                          | Not Applicable                      |

Procurements: This program element is in advanced development and procurement funds are not normally provided until validation and initiation of engineering development; however, a few systems within this program element are prototype systems and are to be followed with procurement funds. Those are summarized below. See program element 6.47.45.A, Tactical Electronic Warfare Systems, for procurement data on systems in engineering development.

|            |  |  |  |  |  |            |                |
|------------|--|--|--|--|--|------------|----------------|
| Funds      |  |  |  |  |  | Continuing | Not Applicable |
| Quantities |  |  |  |  |  | Continuing | Not Applicable |

BRIEF DESCRIPTION OF ELEMENT: The objective of this program element is to establish the technical feasibility and military potential of tactical electronic warfare (EW) equipment including electronic countermeasures (ECM) equipment and electronic

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A Title Tactical Electronic Warfare Equipment

support measures (ESM) equipment. Prototype electronic countermeasures (ECM) and FSM systems such as jammers, direction finders, intercept systems and control and analysis systems are fabricated for concept and military potential evaluation. There are four projects in this program element: n251, Protective Electronic Warfare (EW) System; n905, Division Tactical Electronic Warfare Systems; n925, Corps Tactical Electronic Warfare Systems; and n907, Tactical Electronic Surveillance Systems.

BASIS FOR FY 1978 RDTE REQUEST: Continue tasks initiated in prior years; improve electronic countermeasures (ECM) for armored vehicles, radar detector for countermeasures, advanced development, complete ECM training device, detection and jamming of

program element 6.47.45.A, Tactical Electronic

Warfare Systems.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Increase in funds is required for initiation of

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                           | RDTE | PROCUREMENT | TOTAL | FY 1977<br>and<br>Prior | FY 1978 | Total |
|---------------------------|------|-------------|-------|-------------------------|---------|-------|
| (1) Federal Civ Employees | 92   | 0           | 92    |                         |         |       |
| (2) Contractor Employees  | 165  | 135         | 300   |                         |         |       |
| Total                     | 257  | 135         | 392   |                         |         |       |

Note: Termination costs apply to projects n905 and n925 only.

DETAILED BACKGROUND AND DESCRIPTION: This program element consists of four projects. The objective of this program element is to establish the technical feasibility and military potential of tactical electronic warfare (FW) equipment including electronic countermeasures (ECM) electronic support measures (ESM) systems and tactical electronic surveillance systems. This program includes

TERMINATION COSTS: (\$ in Thousands)

(1) Estimated Government Liability  
Financed with: RDTE

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

the development of electronic warfare equipment to locate and degrade enemy communications.

includes ground vehicular and airborne mounted systems.

Equipment development

RELATED ACTIVITIES: Related electronic warfare developments are conducted by the Air Force and Navy. Coordination is effected between the services to maximize the interchange of technical data and minimize duplication of effort. Coordination is effected by the exchange of technical reports, attendance at scientific meetings and conferences, joint participation on subgroups and working panels of The Technical Cooperation Program, and by the Joint Tri-Service Electronic Warfare Panel. In addition, formal requirements documents of each service are exchanged, reviewed, and commented upon by the other services. Coordination is also accomplished as part of the program reviews conducted by the Office of the Secretary of Defense (Director of Defense Research and Engineering).

WORK PERFORMED BY: US Army Electronic Warfare Laboratory, Fort Monmouth, New Jersey; the Product Manager for Aircraft Survivability Equipment, St. Louis, Missouri; the US Army Security Agency, Arlington Hall Station, Virginia; US Army Materiel Development and Readiness Command, Alexandria, Virginia. The major contractors are; FSL Incorporated, Sunnyvale, California; GTE Sylmar, Mountain View, California; Cincinnati Electronics, Cincinnati, Ohio, RCA Corporation, Camden, New Jersey; Texas Instruments, Dallas, Texas; ITT Corporation, Nutley, New Jersey, IRT Research Institute, Chicago, Illinois.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976 and Prior Accomplishment :

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

2. FY 1977 Program:

3. FY 1978 Planned Program:

4. FY 1979 Planned Program:

5. Program to Completion: This is a continuing program. Programs under development will be evaluated for continuance into engineering development, Program Element 6.47.45.A, Tactical Electronic Warfare Systems.



Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

6. Major Milestones:

Estimated RTE Cumulative Cost to  
Reach Events (Cumulative)  
(\$ in Thousands)

Date

Heliborne communications intercept and jamming system (Quick  
FIX) Type Classification.

Very high frequency communications ground direction finding system  
(TRAILBLAZER) AN/TSQ-114 Type Classification.

Tactical communications emitter location and identification  
system (TACELIS) Type Classification.

Tactical communications jammer, (TACJAM) AN/MLQ-34, Type  
Classification.

Tactical control and analysis centers development test/  
operational test (DT/OT) I completed.

Single channel collection system-forward  
DT I and OT I completed.

Technical electronic support measures (ESM) non-communication  
system Type Classification.

Single channel collection system-rear DT I and OT completed

Expendable tactical communications jammer DT I/OT I  
completed.

Tactical electro-optics electronic warfare DT I/OT I  
completed.

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D251

Title Protective Electronic Warfare Equipment

Category Advanced Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to establish the technical feasibility and military potential of electronic countermeasures (ECM) equipment and electronic support measures (ESM) equipment in protecting ground troops, vehicles, and installations against a variety of threats, such as air-to-surface missiles, anti-tank guided missiles, optical and electro-optical (E-O) range finders and designators, night vision devices, and direction finders. Feasibility and prototype ECM and ESM systems are fabricated for concept and military potential evaluation. The electronic warfare (EW) equipment is intended for use in a self-protection role.

RELATED ACTIVITIES: Other related electronics warfare developments are performed by the Air Force and Navy. Coordination is effected by the exchange of technical reports and information, attendance at scientific meetings and symposia, and participation in tri-service EW subgroups. Coordination is also achieved as part of the program reviews conducted by the Office of the Secretary of Defense (Director of Defense Research and Engineering).

WORK PERFORMED BY: In-house by US Army Electronic Warfare Laboratory, Fort Monmouth, New Jersey. The major contractors are Martin Marietta Corporation, Orlando, Florida; IIT Research Institute, Chicago, Illinois; Georgia Tech Research Institute, Atlanta, Georgia; Sanders Associates Inc., Nashua, New Hampshire; and Cutler Hammer, Inc., Deer Park, New York.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. FY 1977, FY 1976 and Prior Accomplishments: Completed and tested advanced development feasibility model of a terrain avoidance/ side looking airborne radar (SLAR) jammer. Developed and field tested two optically guided anti-tank guided missile (ATGM) ECM equipments, using alternate means for anti-tank guided missile detection (i.e., radar and infrared). Completed development and

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D251

Title Protective Electronic Warfare Equipment

testing of the Multiple Target Electronic Warfare System (MULTEWS). Received delivery and evaluated the electronics of a counter mortar/counter battery expendable jammer. Development was initiated on a (fuel fired infrared (IR) seeking missile countermeasure for protection of Army aircraft. Contrast reduction techniques for helicopters were tested and evaluated. Development of a radar jammer to protect Army aircraft against hostile air defense systems was completed. Development of an airborne radar warning receiver was initiated. A feasibility model of radar electronic countermeasure/electronic countermeasure (ECM/ECCM) training device was delivered, tested and evaluated. Simulation program was initiated to determine the optimum mix of countermeasures and tactics to increase survivability of armored vehicles against guided missiles. Feasibility models of a hand placed hunt lock-on unattended/expendable communications jammer were fabricated and successfully tested in a concept evaluation test. Program was initiated for a design plan for a radar (1) to detect an incoming anti-tank guided missile (ATGM) and (2) to trigger a smoke countermeasure. Programs were initiated for development of countermeasures against (1) beacon tracking ATGM, (2) hostile direction finding (DF) systems and (3) air-to-surface guided missiles.

Received design plan for feasibility model of radar to detect ATGMs and trigger smoke countermeasures. In conjunction with Mobile Equipment Research Development and Acquisition Command (MERADCOM), (IPR) cancelled further development of the miniature infrared alarm (MIRA) and vehicular infrared alarm (VIRA).  
An In-Process Review

2. FY 1977 Program: Complete and deploy Special Purpose ECM System. Continue simulation program to determine optimum mix of countermeasures and tactics to protect armored vehicles against guided missiles. Complete and test second generation advanced development model of radar ECM/ECCM training device. Fabricate and test improved hunt lock-on unattended/expendable communication jammer. Continue program to develop countermeasures against air-to-surface missiles. Initiate programs to procure advanced development feasibility models of microwave expendable jammer, integrated ESM/sensor display for Armored Reconnaissance Scout Vehicle (ARSV). Complete and test optical countermeasure against beacon-tracing ATGM; initiate development of feasibility model. Initiate development of feasibility model of radar to detect ATGMs and trigger smoke countermeasures.

3. FY 1978 Planned Program: Continue developments initiated in FY 1977. Field test feasibility model of integrated ESM/sensor display for ARSV.  
Laser Rangefinder countermeasures  
(CM), CM against electro-optical (E-O) guided air-to-surface missiles and advanced CM against beacon-tracking ATGM. Increase in funding required to fabricate feasibility models for demonstration of military potential and concept.

4. FY 1979 Planned Program: Complete and test advanced development feasibility models initiated in prior years. Initiate development of CM against hostile DF systems, CM against radar guided air-to-surface missiles, and improved integrated ESM/sensor display for ARSV. Increase in funding required to fabricate improved advanced development models.

**Budget Activity #4 - Tactical Programs**

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D251

Title Tactical Electronic Warfare Equipment

5. Program to Completion: This is a continuing program. Efforts will be directed to establishing the technical feasibility and military potential of self-protection electronic warfare (EW) equipment. The objective is to increase the probability of survival (and thus battlefield success) of ground based troops, vehicles and installation. Prototype self-protection (EW) equipment will be fabricated for concept and military potential evaluation.

**RESOURCES: (\$ in Thousands)**

|             | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|-------------|---------|---------|---------|---------|--------------------------------|----------------------------|
|             |         |         |         |         |                                |                            |
| RDTE: Funds | 2033    | 108     | 2121    | 3592    | Continuing                     | Not Applicable             |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.45.A  
Project #D905  
Category Advanced Development  
Title Tactical Electronic Warfare Equipment  
Title Division Tactical Electronic Warfare Systems  
Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to establish the technical feasibility and military potential of tactical electronic warfare (EW) equipment including electronic countermeasures (ECM), and electronic support measures (ESM) systems operating in the Army division. This program includes the development of EW equipment to locate and degrade enemy communications.

Equipment development includes ground vehicular and airborne mounted systems.

RELATED ACTIVITIES: Related electronic warfare developments are conducted by the Air Force and Navy. Coordination is effected between the services to minimize duplication of effort and maximize the interchange of technical data. Coordination is effected by reviews, conducted by the Office of the Secretary of Defense (Director of Defense Research and Engineering), through the exchange of RDTE resume cards and technical reports, attendance at scientific meetings and conferences, and joint participation on subgroups and working panels of the Technical Cooperation Program. In addition, each service's formal requirements documents are reviewed and commented upon by the other services.

WORK PERFORMED BY: US Army Electronic Warfare Laboratory, Fort Monmouth, New Jersey; the Product Manager for Aircraft Survivability Equipment, St. Louis, Missouri; the US Army Security Agency, Arlington Hall Station, Virginia; US Army Materiel Development and Readiness Command, Alexandria, Virginia. The major contractors are: ESL Incorporated, Sunnyvale, California; GTE Sylvaia, Mountainview, California; Cincinnati Electronics, Cincinnati, Ohio; RCA Corporation, Camden, New Jersey; Texas Instruments, Dallas, Texas; IIT Corporation, Nutley, New Jersey; IIT Research Institute, Chicago, Illinois.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 197T, FY 1976, and Prior Accomplishments:



Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Project #D905

Title Tactical Electronic Warfare Equipment

Title Division Tactical Electronic Warfare Systems

2. FY 1977 Program:

3. FY 1978 Planned Program:

4. FY 1979 Planned Program:

5. Program to Completion: This is a continuing program. Programs under development will be evaluated for continuance into engineering development, Program Element 6.47.45.A., Tactical Electronic Warfare Systems.

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D905

Title Division Tactical Electronic Warfare Systems

6. Major Milestones:

|   | <u>Date</u> | <u>Estimated RDTE Cost to Reach Events (Cumulative)</u><br>(\$ in Thousands) |
|---|-------------|--|
| a. Heliborne Communications Intercept and Jamming System (QUICK FIX) Type Classification.                           |             |  |
| b. Very High Frequency Communications Ground Direction Finding System (TRAILBLAZER) AN/TSQ-114 Type Classification. |             |  |
| c. Tactical Control and Analysis Centers Development Test (DT) I/Operational Test (OT) I completed.                 |             |  |
| d. Tactical Communications Emitter Location and Identification System (TACELIS) Type Classification.                |             |  |
| e. Tactical Communications Jammer, (TACJAM) AN/MLQ-34, Type Classification.   |             |  |
| f. Single Channel Collection System, Forward DT I/OT I completed.   |             |  |
| g. Expendable Tactical Communications Jammer DT I/OT I completed.   |             |  |
| h. Tactical Electro-Optics Electronic Warfare DT I/OT I completed.  |             |  |

RESOURCES: (\$ in Thousands)

|                     | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional to Completion Continuing</u> | <u>Total Estimated Cost</u><br><u>Not Applicable</u><br><u>Not Applicable</u> |
|---------------------|----------------|----------------|----------------|----------------|--|---|
| <u>EDTR: Funds</u>  |                |                |                |                |  |   |
| <u>Quantities</u>   |                |                |                |                |  |   |
| <u>Procurement:</u> |                |                |                |                |  |   |
| <u>Funds</u>        | 11780          | 78             | 53900          | 138486         |  |   |
| <u>Quantities</u>   | 2              | 0              | 20             | 43             |  |   |

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Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Project #D905

Title Tactical Electronic Warfare Equipment

Title Division Tactical Electronic Warfare System

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. Very High Frequency Communications Ground Direction Finding System (AN/TSQ-114) (TRAILBLAZER): This system is being fabricated by US Army Electronics Command. Equipment is being obtained on a Quick Reaction Capability (QRC) basis, consequently, Developmental Test (DT) I data has been substantiated by already available performance data on components and subassemblies. This performance information has verified suitability of items selected for this system. The complete system will undergo

A three-month period will be allocated for

b. Single Channel Collection System, Forward: This task is currently undergoing investigative actions to formulate the related objectives and a relative test program. Actual hardware development will be initiated in FY 78. A Coordinated Test program to define and schedule appropriate tests will be prepared concurrently with a development plan at that time. A tentative development test (DT) plan provides

c. Tactical Control and Analysis Center (CAC): An initial contract for development of a software module was awarded to GTE, Sylvania in FY 73. A contract for the advanced development model of the Control and Analysis Center was awarded in

d. Tactical Communications Electronic Warfare System (TACOM EW): The purpose of the TACOM EW development effort is to equip US Army forces with an electronic warfare system that will exploit the enemy's dependence on

TACOM EW consists of the following two subsystems:

(1) Tactical Communications Emitter Location and Identification System (TACELIS): The primary contractor in development and fabrication of this system is GTE Sylvania. TACELIS system hardware has not been subject to DT I; however, individual component performance has been verified by contractor testing to demonstrate compliance with subsystem specifications. The complete system will be subjected to an extensive, to examine hardware suitability and adequacy of performance criteria. An initial production TACELIS system will be made available for

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D905

Title Division Tactical Electronic Warfare System

(2) Tactical Communications Jammer (TACJAM): TACJAM system is being fabricated by GTE Sylvania. The system hardware has not been subject to DT I; however, individual component performance has been verified by contractor testing to demonstrate compliance with subsystem specifications. Subsystem and component testing has also been conducted at US Army Security Agency Test and Evaluation Center, Ft. Huachuca, Arizona. The draft results of this test indicate that performance will meet specifications. The TACJAM system is currently being reconfigured to a tracked configuration to increase the survivability of the system. The entire system will be subjected to            to examine hardware suitability and adequacy of performance criteria.

e. Heliborne Communications Electronic Countermeasure/Electronic Support Measures (ECM/ESM) (QUICK FIX): The QUICK FIX system is being fabricated by ESL Incorporated with standard subassemblies and an improved direction finding (DF) subsystem. Original system testing (1971/1972) confirmed the feasibility of QUICK FIX but disclosed the inadequacy of the DF subsystem and the need for some corrective measures in the ECM system. The required design changes are now being fabricated and the complete system will undergo           

f. Tactical Electro-Optics Electronic Warfare (TAC EO EW):

g. Expendable Communications Jammer:

2. Operational Test and Evaluation:

a. Very High Frequency Communications Ground Direction Finding System (AN/TSQ-114) (TRAILBLAZER): Operational Test (OT) I has not been conducted since this system was developed on a Quick Reaction Capability basis using previously tested components and subsystems. OT II will be conducted by US Army Training and Doctrine Command (TRADOC) Combined Arms Testing Activity (TCATA) at Fort Hood, Texas. OT II will be used to evaluate the system's operational effectiveness; to refine system organizational employment concepts; and as a basis for decisions on type classification and low rate initial production. The system will be operated and maintained by representative personnel from an Army Security Agency (ASA) Division Support Company. OT III will be scheduled following OT II. The Operational Test and Evaluation Agency (OTEA) will monitor the testing.

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D905

Title Division Tactical Electronic Warfare System

b. Single Channel Collection System, Forward: Hardware development will be initiated in FY 78. A coordinated test program to define and schedule appropriate tests will be prepared and an organizational/operational concept developed at an appropriate time. Current planning provides for Test monitor will be TCATA, Ft. Hood, Texas.

c. Tactical Control and Analysis Center (CAC): Operational Test (OT) I will be conducted by US Army Training and Doctrine Command (TRADOC) in conjunction with Developmental Test (DT) I. OT I will provide an assessment of military worth, operational suitability, potential, and effectiveness of the system, and will refine and develop operational issues for subsequent testing. The system will be operated and maintained by representative personnel from an Army Security Agency (ASA) Control and Processing Company. Both Forward and Primary configurations will be tested. Testing will be conducted as follows:

Reliability, Availability, and Maintainability will be evaluated in both OT I and OT II. Testing will be monitored by the Operational Test and Evaluation Agency (OTEA).

d. TACOM EW (Tactical Communications Electronic Warfare) System:

(1) Tactical Communications Emitter Location and Identification System (TACELIS): TACELIS system hardware has not been subjected to OT I; however, individual component performance has been verified by contractor testing to demonstrate compliance with subsystem specifications. For this reason, an advanced development prototype was not built. OT II will be conducted (on the engineering development prototype system) by TRADOC following the completion of DT II. An integrated operational testing program for Tactical Communications Jammer (TACJAM), TACELIS, and AN/UHQ-71 (CEFLY LANCER - airborne communications intercept and location system) in both their independent and interdependent roles, has been developed. OT III will be scheduled following OT II. OTEA will monitor the entire testing program.

(2) Tactical Communications Jammer (TACJAM): OT I has not been conducted on this program for same reason noted in paragraph d(1), above. OT II will be conducted by OTEA in OT III will be scheduled following OT II.

e. Heliborne Communications Electronic Countermeasure/Electronic Support Measures (ECM/ESM) (QUICK FIX): Military Potential Test of the QUICK FIX system was conducted by United States Army Security Agency (USASA) at Fort Huachuca, Arizona, January - February 1972, followed by a limited test and evaluation conducted by Modern Selected System Test and Evaluation Review (MASSTER) at Fort Hood, Texas, in March 1972. The system

An OT II will be conducted by TRADOC Combined Arms Test Activity (TCATA) at Fort Hood, Texas, to evaluate the direction finding (DF), intercept, and electronic countermeasures (ECM) subsystem. to refine organizational and operational



Budget Activity #4 - Tactical Programs

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concepts, and to form a basis for type classification action. The system will be operated and maintained by representative personnel from a USASA Division Support Company. — — OTEA will monitor OT II and III. OT III will be conducted.

f. Tactical Electro-Optics Electronic Warfare (TAC EO EW):

g. Expendable Communication Jammer: The only developmental effort to date on this effort is support to TRADOC during its concept formulation phase. Hardware development will be initiated in [FY 78.] Current schedule provides for OT I in Test monitor will be TRADOC Combined Arms Testing Activity (TCATA), Fort Hood, Texas.

3. Systems Characteristics:

Operational/Technical

Objective

Demonstrated

a. Very High Frequency (VHF) Ground Direction Finding System (TRAILBLAZER)

- (1) Frequency Range
- (2) Azimuth Coverage
- (3) Range
- (4) Location Accuracy
  - Range
  - Bearing
- (5) Platform
- (6) Target Classes



b. Single Channel Collection System, Forward (SCCS) (F): Hardware specifications have not yet been stated. For planning purposes it is anticipated the SCCS,F will operate

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Project #D905

Title Tactical Electronic Warfare Equipment

Title Division Tactical Electronic Warfare Systems

c. Tactical Control and Analysis Center (CAC)

Note:

Operational/Technical

- (1) Design appropriate software

d. TACOM EW (Tactical Communications Electronic Warfare) System

- (1) TACELIS (Tactical Communications Emitter Location and Identification System)
- (1) Frequency Range (intercept)
  - (2) Frequency Range (direction finding)
  - (3) Azimuth Coverage
  - (4) Location Accuracy
    - Range
    - Angle
  - (5) Mode
  - (6) Target Classes

Objective

Demonstrated

|  |                              |   |                     |
|--|------------------------------|---|---------------------|
| Budget Activity #4 - Tactical Programs   |                              |   |                     |
| Program Element #6.37.45.A   |                              | Title Tactical Electronic Warfare Equipment       |                     |
| Project #D905  |                              | Title Division Tactical Electronic Warfare System |                     |
|  | <u>Operational/Technical</u> | <u>Objective</u>                                  | <u>Demonstrated</u> |
| (2) TACJAM (Tactical Communications Jammer)  |                              |   |                     |
| (1) Frequency Range  |                              |   |                     |
| (2) Effective radiated power   |                              |   |                     |
| (3) Modulation   |                              |   |                     |
| (4) Platform   |                              |   |                     |
| (5) Target Classes   |                              |   |                     |
| e. Heliborne Communications Intercept and Jamming System (QUICK FIX) with direction finding (DF) |                              |   |                     |
| (1) Frequency Range  |                              |   |                     |
| (2) Location Accuracy  |                              |   |                     |
| (3) Effective Radiated Power (ERP)   |                              |   |                     |
| (4) Communications   |                              |   |                     |
| (5) Platform   |                              |   |                     |
| (6) Target Classes   |                              |   |                     |
| f. Tactical Electro-Optics (E-O) Electronic Warfare (EW):  |                              |   |                     |
| g. Expendable Communications Jammers:  |                              |   |                     |

FY 1978 RPT. DESCRIPTIVE SUMMARY

|                 |                             |                 |  |
|-----------------|-----------------------------|-----------------|--|
| Program Element | <u>#6.37.45.A</u>           | Title           | <u>Tactical Electronic Warfare Equipment</u>   |
| Project         | <u>#D907</u>                | Title           | <u>Tactical Electronic Surveillance System</u> |
| Category        | <u>Advanced Development</u> | Budget Activity | <u>#4 - Tactical Programs</u>                  |

DETAILED BACKGROUND AND DESCRIPTION: Data originating from a variety of electronic surveillance sensors of strategic programs is transmitted over short and long distances to collection points. Techniques and equipment are to be provided for expediting the collection of target acquisition information and for the rapid dissemination of tactical intelligence. Means of exploiting advanced techniques of data transmission will be developed to use information collected by tactical surveillance systems more effectively by making the information available in the command and control environment in a sufficiently timely and useful form to influence field operations. The purpose of the project is to collect, process and disseminate through command and control interfaces parameter information which identifies and locates hostile emitters representing a particular threat with intercept frequency from A to K Band.

RELATED ACTIVITIES: Technological developments designed to shorten the time required to collect and disseminate information are related to this development.

basis for the equipment and techniques were addressed under 6.27.15.A A448 and 6.37.11.A D907 Tactical Surveillance System.

WORK PERFORMED BY: US Army Security Agency, Arlington Hall Station, Arlington, VA; Aerospace Corporation, El Segundo, CA; Lockheed Missiles and Space Corporation, Sunnyvale, CA; Electromagnetic Systems Laboratories, Sunnyvale, CA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976 and Prior Accomplishments: Studies were initiated to provide the technical basis for the equipment and techniques for systems development and interface definitions with a variety of collection systems.

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D907

Title Tactical Electronic Surveillance System

2. FY 1977 Program: Studies will be completed to provide the technical basis for the equipment and techniques for systems development and interface definition with a variety of strategic collection systems.
3. FY 1978 Planned Program: Complete system(s) design. Initiate installation of interface equipments. Initiate advanced system(s) development for interface with a strategic collection program. The increase in funds over FY 1977 is the result of initiating this advanced development.
4. FY 1979 Planned Program: Complete installation of interface equipments. Initiate Advanced Development of system for interface with strategic collection program not addressed in FY 77 and FY 78. Increase in funds is to support advanced development interface with additional collection systems.
5. Program to Completion: An engineering development level systems for interface with a selected strategic collection programs will be completed in

RESOURCES: (\$ in thousands)

| RDTE: Funds | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion |      | Total Estimated Cost | Continuing | Not Applicable |
|-------------|---------|---------|---------|---------|--------------------------|------|----------------------|------------|----------------|
|             |         |         |         |         | Completion               | Cost |                      |            |                |
|             |         |         |         |         |                          |      |                      |            |                |



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D925

Title Corps Tactical Electronic Warfare Systems

Category Advanced Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to establish the technical feasibility and military potential of tactical electronic warfare (EW) equipment including electronic countermeasures (ECM), and electronic support measures (ESM) systems for operation in the Army corps. This program includes the development of EW equipment to locate and degrade enemy communications, non-communications emitters, infrared and optical battlefield surveillance devices and provide tactical electronic order of battle information. Equipment development includes ground vehicular and airborne mounted systems.

RELATED ACTIVITIES: Related electronic warfare developments are conducted by the Air Force and Navy. Coordination is effected between the services to minimize duplication of effort and maximize the interchange of technical data. Coordination is effected by reviews, conducted by the Office of the Secretary of Defense (Director of Defense Research and Engineering), through the exchange of RDTE resume cards and technical reports, attendance at scientific meetings and conferences, and joint participation on subgroups and working panels of the Technical Cooperation Program. In addition, each service's formal requirements documents are reviewed and commented upon by the other services.

WORK PERFORMED BY: US Army Electronic Warfare Laboratory, Fort Monmouth, New Jersey; the Product Manager for Aircraft Survivability Equipment, St. Louis, Missouri; the US Army Security Agency, Arlington Hall Station, Virginia; US Army Materiel Development and Readiness Command, Alexandria, Virginia.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments:

Budget Activity # - Tactical Programs

Program Element #6.37.45.A

Project #D925

2. FY 1977 Program:

3. FY 1978 Planned Program:

4. FY 1979 Planned Program:

5. Program to Completion: This is a continuing program. Programs under development will be evaluated for continuance into engineering development, Program Element 6.47.45.A, Tactical Electronic Warfare Systems.

6. Major Milestones:

- a. Technical electronic support measures (ESM) non-communications system Type Classification
- b. Single channel collection system, rear Developmental Test (DT) I and Operational Test (OT) I completed.

RESOURCES: (\$ in Thousands)

Estimated RDTE Cost to  
Reach Events (Cumulative)  
(\$ in Thousands)

Date

| RDTE: Funds<br>Quantities | FY 1976 | FY 1977 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion |      | Total<br>Estimated<br>Cost | Not Applicable<br>Not Applicable |
|---------------------------|---------|---------|---------|---------|---------|--------------------------------|------|----------------------------|----------------------------------|
|                           |         |         |         |         |         | Continuing                     | Cost |                            |                                  |
|                           |         |         |         |         |         |                                |      |                            |                                  |

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Title Tactical Electronic Warfare Equipment

Project #D925

Title Corps Tactical Electronic Warfare Systems

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. Technical Electronic Support Measure (ESM) Non-Communications System: This project is undergoing investigative action to formulate the development objectives and a related test program. A Coordinated Test Program to define and schedule appropriate tests will be prepared concurrent with a Development Plan. A tentative Development Test (DT) schedule provides for

b. Single Channel Collection System, Rear: This task is in the formulation stage to develop program objectives and related test program. Two important subassemblies have undergone feasibility testing/operational testing. These are the Automatic Manual Morse Recovery System (AMARS) developed in-house at the United States Army Security Agency (USASA) Analysis and Application Facility which underwent extended testing in Europe during 1976 and the Special Signal Analysis System, high frequency (HF), developed by Southwest Research Institute which underwent a limited feasibility test in early 1976. A coordinated test program will be developed with the outline development plan. A tentative DT schedule provides for

2. Operational Test and Evaluation:

a. Technical ESM Non-Communications System: An Operational Test (OT) II will be conducted by the US Army Training and Doctrine Command (TRADOC) during the OT II. A coordinated test program is being formulated for

b. Single Channel Collection System, Rear: An OT I will be conducted by TRADOC during  
A subsystem of the Single Channel Collection System, Rear, the

compared with  
test program is being formulated for OT II. The operational characteristics of the AMARS was  
The results of this test have yet to be assessed. A coordinated

Budget Activity #4 - Tactical Programs

Program Element #6.37.45.A

Project #D925

Title Tactical Electronic Warfare Equipment

Title Corps Tactical Electronic Warfare Systems

3. Systems Characteristics:

a. Technical Electronic Support Measures (TECH ESM) system:

Operational Characteristics

- (1) Frequency Range
- (2) Platform
- (3) Range
- (4) Mode
- (5) Communications
- (6) DF Accuracy
- (7) Sensitivity
- (8) Target classes

Objectives

Demonstrated

b. Single Channel Collection System (SCCS) rear:

Operational Characteristics

- (1) Frequency
- (2) Range
- (3) Mode
- (4) Communications
- (5) Target Classes

Objectives

Demonstrated

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.37.46.A Title Single Channel Ground and Airborne Radio Subsystem (SINGGARS-V)

Category Advanced Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number                          | Title   | FY 1976     | FY 1977     | FY 1978      | FY 1979      | Additional to Completion | Total Estimated Cost |
|---|---|-------------|-------------|--------------|--------------|--------------------------|----------------------|
|   | <u>TOTAL FOR PROGRAM ELEMENT</u>                                | <u>1240</u> | <u>3950</u> | <u>11328</u> | <u>14592</u> | <u>43511</u>             | <u>75118</u>         |
|   | Quantities  |             |             |              | 30           | 125                      |                      |
| D555                                    | Single Channel Ground and Airborne Radio Subsystem (SINGGARS-V) | 1240        | 3950        | 11328        | 14592        | 43511                    | 75118                |
| Procurement: To be initiated in FY 1983 |   |             |             |              |              |                          |                      |
|   | Funds   |             |             |              |              | 932                      | 932                  |
|   | Quantities  |             |             |              |              | 191,800                  | 191,800              |

BRIEF DESCRIPTION OF ELEMENT: The objective is to perform development of a family of single channel Very High Frequency/Frequency Modulation (VHF/FM) combat net radios for the Combat Arms.

BASIS FOR FY 1978 RDT&E REQUEST: Start two contractual efforts and monitor foreign candidate radio developments. Establish a contract for advanced development of a fast frequency hopping radio.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Major contractual effort will be started in FY 1978.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDT&E and Procurement), is as follows:



Budget Activity #4 - Tactical Programs

Program Element #6.37.46.A Title Single Channel Ground and Airborne Radio Subsystem (SINGGARS-V)

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 37   | 0           | 37    |
| (2) Contractor Employees   | UNK* | 0           | UNK*  |
| Total                      | 37*  | 0           | 37*   |

\*Number of contractor employees to be supported with requested RDTE funds is currently unknown; applicable contracts not yet awarded.

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to perform development of a family of single channel Very High Frequency/Frequency Modulation (VHF/FM) combat net radios to be organic to and operated by the Combat Arms. The family will consist of three configurations, a manpack, a vehicular and an aircraft radio. These radios will be modularized, securable and possess anti-jamming and anti-position-fixing features. The new radios will replace the currently standard vehicular, manpack and aircraft radios -- the AN/VRC-12 family, the AN/VRC-77 family and the AN/ARC-114, respectively.

RELATED ACTIVITIES: Program Element 6.27.01.A, Communications Electronics, Program Element 6.37.07.A, Communications Development, and Program Element 6.47.01.A, Communications Engineering Development, provide exploratory, advanced and engineering developments of related and supporting single channel net radio equipment. Through FY 1977 advanced development of the SINGGARS-V radio will be conducted in Program Element 6.37.07.A, Project N437 (Tactical Radio Communication Systems). Other service requirements are contained in an approved joint operational requirement document. Army is lead-service for acquisition.

WORK PERFORMED BY: The in-house developing organizations are the US Army Communications Research and Development Command (CDRADCOM), Fort Monmouth, NJ and US Army Test and Evaluation Command, Fort Huachuca, Arizona. Contractual efforts will be accomplished by contractors to be selected in FY 1978.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 77, FY 76 and Prior Accomplishments: Results of the AN/VRC-78 contracts and other prior developments were analyzed by the SINGGARS-V Special Task Force, CDRAIDCOM, and the SINGGARS Project Management Office in preparation of the procurement packages for the two SINGGARS-V solicitations. Office of the Project Manager, SINGGARS was established in April 1975. A Test Integration Working Group (TIWG) was established and the SINGGARS-V Coordinated Test Program was formulated. Secretary of Defense approval of the advanced development (validation) program was obtained. An Electromagnetic Compatibility/Vulnerability (EMC/FMV) Analysis of the SINGGARS-V system in support of the Advanced Development effort was begun and the solicitations for the SINGGARS-V radios were prepared.

Budget Activity #4 - Tactical Programs

Program Element #6.37.46.A Title Single Channel Ground and Airborne Radio Subsystem (SINGGARS-V)

2. FY 1977 Program: The FY 77 SINGGARS-V effort will be conducted in Program Element 6.37.07.A. Contractual advanced development will be initiated by soliciting two competitive prototype contracts, each for design and fabrication of 31 slow frequency hopping radios. Complete an electromagnetic interference/vulnerability analysis for frequency hopping radios and apply the results to the contractual efforts. Expand the scope of a previously established Test Integration Working Group. Establish Memorandua of Understanding with appropriate foreign governments for procurement and evaluation of foreign candidate radios.

3. FY 1978 Program: The FY 78 SINGGARS-V program will be completely transferred from Program Element 6.37.07.A to this Program Element. Monitor the performance of the two contracts established in FY 78. Establish a third contract for design and fabrication of 31 fast frequency hopping radio prototypes. Coordinate the radio design with communication security (COMSEC) system development. Monitor the development and evaluation of foreign candidate radios. Increase in funds in FY 1978 over FY 1977 is due to increased incremental funding requirements for contractual effort.

4. FY 1979 Program: Continue coordination and monitoring of existing contracts. Plan for the procurement of foreign candidate radios. Plan the developmental and operational testing of all candidate radios. Increase in funds in FY 1979 over FY 1978 is due to larger contractual effort.

5. Program to Completion: Complete advanced development select a candidate system and proceed into engineering development and then production.

5. Major Milestones:

| SINGGARS-V   | Date   | Estimated RDTE Cost to    |  |
|--|--------|---------------------------|--|
|  |        | Reach Events (Cumulative) |  |
| a. SINGGARS-V Defense Systems Acquisition Review Council (DSARC-I) | Feb 76 | 1680                      |  |
| b. Complete developmental testing                                  | Jan 81 | 31620                     |  |
| c. Complete operational testing                                    | Apr 81 | 36035                     |  |
| d. SINGGARS-V DSARC-II   | Sep 81 | 40450                     |  |

Budget Activity #4 - Tactical Programs

Program Element #6.37.46.A

Title Single Channel Ground and Airborne Radio System (SINCGARS-V)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

- a. A contractor has not been selected for this program at this time.
- b. All testing for this program is in the planning stage. A Coordinated Test Plan (CTP) for the first phase of testing has been prepared. The CTP displays an adequate test schedule through April 1981. Development testing will begin with DT I in Sep 1980 and the critical issues will be addressed in all testing. Three contractors will participate through Development Testing (DT) II to keep costs of procurement as low as possible. DT II is scheduled to begin June 1982 and DT III in December 1984. Reliability data will be collected throughout development testing.

2. Operational Test and Evaluation: No testing has been accomplished to date. Operational Testing (OT) planned and executed by OTFA will begin with OT I in January 1981. Testing will determine whether operational communications requirements of the division, both secure and in the clear, are satisfied. Soldiers will determine reliability, ease of maintenance and interoperability with other tactical communications systems. OT II will begin in November 1982 and OT III in April 1985. Test sites have not been determined but it will be where a division and maneuver area are available.

3. System Characteristics:

Operational

Characteristics

Demonstrated  
Performance 1/

Objective

1. Advanced Radio Systems Developments

25 Kilo Hertz

- a. Optimum Very High Frequency-Frequency Modulation digital transmission at 16 Kilobits/ per second between 30-88 Mega Hertz

- b. Available channels

2400

Budget Activity #4 - Tactical Programs

Program Element #6.37.46.A

Title Single Channel Ground and Airborne Radio Subsystem (SINGARS-V)

Operational Characteristics

2. Manpack Configuration

- a. Size (cu in) complete system 250
- b. Weight (lbs) including security device and Electronic Counter Measures (ECM) modules 20
- c. Weight (lbs) without Communications Security (COMSEC) device 17

3. System Reliability (MTBF-hours) 2/

1/ No testing performed to date.

2/ Mean Time Between Failure (MTBF) criteria not yet finalized; to be provided not later than 60 days after advanced development contract award.

Objective Demonstrated 1/

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.42.01.A

Title Aircraft Avionics

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES/PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                 | TOTAL FOR PROGRAM ELEMENT Quantities | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost |
|----------------|---------------------------------------|--------------------------------------|---------|---------|---------|---------|-------------------------------------|----------------------|
|                |                                       |                                      |         |         |         |         |                                     |                      |
| DC96           | Aircraft Navigation & Control Systems | 3793                                 | 465     | 1650    | 1227    | 4000    | Continuing                          | Not Applicable       |
| DC97           | Avionics Systems                      | 1595                                 | 600     | 2167    | 3651    | 2801    | Continuing                          | Not Applicable       |

**BRIEF DESCRIPTION OF ELEMENT:** This program element provides for engineering development leading to production of both airborne and ground avionics equipment.

**BASIS FOR FY 1978 RDTE REQUEST:** The FY 1978 request supports AN/TSW-7A control tower and AN/ASN-128 Doppler Development Test III; engineering development of the Joint Tactical Microwave Landing System (JTMLS), Integrated Avionics Control System (IACS), electronic counter countermeasures (ECCM) applique, noise reduction headset/microphone and audio multiple notch filter; and continuing system installation and engineering effort.

**BASIS FOR CHANGE IN FY 1978 OVER FY 1977:** The increase in FY 1978 over FY 1977 is due to funding profiles of the integrated avionics control system (IACS), the noise reduction headset/microphone, the multiple notch filter and the ECCM applique.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and procurement) is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 109         | 0                  | 109          |
| (2) Contractor Employees   | 76          | 0                  | 76           |
| Total                      | 185         | 0                  | 185          |



Budget Activity #4 - Tactical Programs

| Program Element | #6.42.01.A | Title | Aircraft Avionics |
|-----------------|------------|-------|-------------------|
|-----------------|------------|-------|-------------------|

DETAILED BACKGROUND AND DESCRIPTION: The engineering developments provided by this program element are the basis for future production of aviation electronics equipment and systems for Army aviation. It includes both airborne hardware and associated ground equipment developments. Principal interest is focused on Army helicopters and improving their capability to operate at low level/nap-of-the-earth altitudes while supporting ground combat forces at night and during adverse weather. The program element is composed of two projects: Aircraft Navigation and Control Systems (DC96) and Avionics Systems (DC97). Included are developments in navigation, landing systems, air traffic control, communications and system installation and engineering.

RELATED ACTIVITIES: Related programs of other Services and the Federal Aviation Agency are monitored by the Army through committees, working groups, and joint developments to take advantage of equipment developed in other programs. This Program Element is related to program elements 6.22.02.A (Aircraft Avionics Technology) and 6.32.07.A (Aircraft Avionics Equipment).

WORK PERFORMED BY: US Army Aviation Research and Development Command, Avionics Laboratory (Project DC97) and Project Manager Navigation and Control (Project DC96), Ft. Monmouth, NJ. Contractors include: RCA Corporation, Burlington, MA; Singer-Kearfott, Little Falls, NJ; Teledyne Ryan, San Diego, CA; Bendix Communications, Baltimore, MD; Texas Instruments Inc., Dallas, TX; GTE, Pennsylvania, Needham, MA; Hoffman Electronics, El Monte, CA; AEL Service Corporation, Farmingdale, NJ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Engineering development was completed for the AN/TRN-30 low frequency beacons and the AN/TSQ-97 man portable control tower. Engineering development of the AN/ARC-98 radio, the AN/TSW-7A transportable control tower (modification of the Air Force AN/TSW-7) and the Tactical Landing System (TLS) was completed. Engineering development of the AN/ARN-114 LORAN and the AN/ASN-128 Doppler continued. Engineering development of the integrated avionics control system (IACS) was started. The IACS will use an integrated control panel and multiplexing techniques, and result in a significant saving in cockpit space.
2. FY 1977 Program: Engineering development of the Joint Tactical Microwave Landing System (JTMLS) will be initiated. The objective of the JTMLS development is obtain tactical equipment compatible with the Federal Aviation Agency (FAA) National Microwave Landing System. Engineering development of the AN/ARN-114 LORAN and AN/ASN-128 Doppler will be completed. Productivity engineering and planning effort for the AN/ASN-128 Doppler will be accomplished. Competitive engineering development contracts for the integrated avionics control system (IACS) will be awarded. Engineering development of the noise reduction headset/microphone will be initiated. System installation and engineering effort will continue.

Budget Activity #4 - Tactical Programs

Program Element #6.42.01.A

Title Aircraft Avionics

3. FY 1978 Planned Program: The AN/TSW-7A control tower and the AN/ASN-128 Doppler will undergo Development Test III. The JTMLS will undergo Development and Operational Test II. Engineering development of the IACS will continue and engineering development of the noise reduction headset/microphone will be completed. Engineering development of a multiple notch filter and an electronic counter-countermeasure (ECCM) applique will be initiated. System installation and engineering effort will continue. The increase in FY 78 over FY 77 is due to the engineering development funding profiles of the IACS, noise reduction headset/microphone, the multiple notch filter and the ECCM applique.
4. FY 1979 Planned Program: Engineering Development of the Joint Tactical Microwave Landing System (JTMLS) will be completed. Engineering development of a lightweight inertial navigation system (adaptation of Air Force standard inertial system) will be initiated. Integrated avionics control system (IACS) engineering development will be completed. Engineering development of a hover sensor and a retransmission system for tactical frequency modulated (FM) radios will be initiated. System installation and engineering effort will continue. The increase in FY 79 over FY 78 is due to the engineering development funding profile of the lightweight inertial navigation system.
5. Program to Completion: This is a continuing program.

FY 1978 RDTE DESCRIPTIVE SUMMARY

|                 |                                |                 |  |
|-----------------|--------------------------------|-----------------|--|
| Program Element | <u>#6.42.01.A</u>              | Title           | <u>Aircraft Avionics</u>                       |
| Project         | <u>#DC 96</u>                  | Title           | <u>Aircraft Navigation and Control Systems</u> |
| Category        | <u>Engineering Development</u> | Budget Activity | <u>#4 - Tactical Programs</u>                  |

DETAILED BACKGROUND AND DESCRIPTION: The engineering developments provided by this project are the basis for future production of aviation electronics equipment and systems for Army aviation. It includes both airborne hardware and associated ground equipment developments. Principal interest is focused on Army helicopters and improving their capability to operate at low level/nap-of-the-earth altitudes while supporting ground combat forces at night and during adverse weather. Included are developments in navigation, landing systems and air traffic control.

RELATED ACTIVITIES: Related programs of other Services and the Federal Aviation Agency are monitored by the Army through committees, working groups, and joint developments to take advantage of other equipment developed in other programs. This Program Element is related to Program Elements 6.22.02.A (Aircraft Avionics Technology) and 6.32.07.A (Aircraft Avionics Equipment) and to Project DC97 (Avionics Systems) in this program element.

WORK PERFORMED BY: Project Manager Navigation and Control, Ft. Monmouth, NJ. Contractors include: RCA Corporation, Burlington, MA; Singer-Kearfott, Little Falls, NJ; Teledyne Ryan, San Diego, CA; Bendix Communications, Baltimore, MD; Texas Instruments Inc., Dallas, TX.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Engineering development was completed for the AN/TRN-30 low frequency beacons and the AN/TSQ-97 man portable control tower. Engineering development of the AN/TSM-7A transportable control tower (modification of the Air Force AN/TSM-7) and the Tactical Landing System (TLS) was completed. Engineering development of the AN/ARN-114 LORAN and the AN/ASN-128 Doppler continued.
2. FY 1977 Program: Engineering development of the Joint Tactical Microwave Landing System (JMTLS) will be initiated. The objective of the JMTLS development is to obtain tactical equipment compatible with the Federal Aviation Agency (FAA) National Microwave Landing System. Engineering development of the AN/ARN-114 LORAN and AN/ASN-128 Doppler will be completed. Producibility engineering and planning effort for the AN/ASN-128 Doppler will be accomplished.

Budget Activity #4 - Tactical Programs

Program Element #6.42.01.A

Title Aircraft Avionics

Project #DC96

Title Aircraft Navigational and Control Systems

3. FY 1978 Planned Program: The AN/TSW-7A control tower and the AN/ASN-128 Doppler will undergo Development Test III. The Joint Tactical Microwave Landing System (JTMLS) will undergo Development and Operational Test II. Decrease in FY 1978 is due mainly to reduced funding requirements for JTMLS and the AN/ASN-128 Doppler.

4. FY 1979 Planned Program: Engineering development of the JTMLS will be completed. Engineering development of a lightweight inertial navigation system (adaptation of Air Force standard inertial system) will be initiated. Increase in FY 1979 is due to the start of this development program.

5. Program to Completion: This is a continuing program.

RESOURCES: (\$ in Thousands)

|            | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|------------|---------|---------|---------|---------|--------------------------------|----------------------------|
| RDTE Funds | 3793    | 465     | 1227    | 4000    | Continuing                     | Not Applicable             |



FY 1978 RDT&E DESCRIPTIVE SUMMARY

|                 |                                |                 |                               |
|-----------------|--------------------------------|-----------------|-------------------------------|
| Program Element | <u>#6.42.01.A</u>              | Title           | <u>Aircraft Avionics</u>      |
| Project         | <u>#DC 97</u>                  | Title           | <u>Avionics Systems</u>       |
| Category        | <u>Engineering Development</u> | Budget Activity | <u>#4 - Tactical Programs</u> |

DETAILED BACKGROUND AND DESCRIPTION: The engineering developments provided by this project are the basis for future production of aviation electronics equipment and systems for Army aviation. It includes both airborne hardware and associated ground equipment developments. Principal interest is focused on Army helicopters and improving their capability to operate at low level/nap-of-the-earth altitudes while supporting ground combat forces at night and during adverse weather. Included are developments in communications and in system installation and engineering.

RELATED ACTIVITIES: Related programs of other Services and the Federal Aviation Agency are monitored by the Army through committees, working groups, and joint developments to take advantage of equipment developed in other programs. This Program Element is related to Program Elements 6.22.02.A (Aircraft Avionics Technology) and 6.32.07.A (Aircraft Avionics Equipment) and to Project DC96 (Aircraft Navigation and Control Systems) in this program element.

WORK PERFORMED BY: US Army Aviation Research and Development Command, Avionics Laboratory, Ft. Monmouth, NJ. Contractors include: GTE Sylvania, Needham, MA; Hoffman Electronics, El Monte, CA; AEL Service Corporation, Farmingdale, NJ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Engineering development of the AN/ARC-98 radio was completed. Engineering development of the integrated avionics control system (IACS) was started. The IACS will use an integrated control panel and multiplexing techniques, and result in a significant saving in cockpit space.
2. FY 1977 Program: Competitive, design-to-cost engineering development contracts for the IACS will be awarded. Engineering development of the noise reduction headset/microphone will be initiated. System installation and engineering effort will continue.
3. FY 1978 Planned Program: Engineering development of the IACS will continue. Engineering development of the noise reduction headset/microphone will be completed. Engineering development of a multiple notch filter and an electronic counter-countermeasures (ECCM) applique will be initiated. System installation and engineering effort will continue. The increase in FY 1978 is due to the engineering development funding profiles of the IACS, noise reduction headset/microphone, the multiple notch filter and the ECCM applique.



Budget Activity #4 - Tactical Programs

Program Element #6.42.01.A

Title Aircraft Avionics

Project #DC97

Title Avionics Systems

4. FY 1979 Planned Program: Integrate Avionics Control System (IACS) engineering development will be completed. Engineering development of a hover sensor and a retransmission system for tactical frequency modulated (FM) radios will be initiated. System installation and engineering effort will continue. The decrease in FY 1979 is due to the engineering development funding profiles of the IACS, noise reduction headset/microphone and the multiple notch filter.

5. Program to Completion: This is a continuing program.

RESOURCES: (\$ in Thousands)

|            | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional<br/>to<br/>Completion</u> | <u>Total<br/>Estimated<br/>Cost</u> |
|------------|----------------|----------------|----------------|----------------|---|-------------------------------------|
| RDTE Funds | 1595           | 2167           | 3651           | 2801           | Continuing                              | Not Applicable                      |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.42.02.A

Title Aircraft Weapons

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                      | TOTAL FOR PROGRAM ELEMENT | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|----------------------------|---------------------------|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | Quantities                 |                           | 4765    | 2665    | 3925    | 15766   | 10723                               |                                     |
| ML62           | Aircraft Rocket Subsystems | 2638                      | 1930    | 900     | 5144    | 5323    | Continuing                          | Not Applicable                      |
| DI33           | Aircraft Gun Type Weapons  | 2127                      | 735     | 3025    | 10622   | 5400    | Continuing                          | Not Applicable                      |

BRIEF DESCRIPTION OF ELEMENT: This program supports the development and test of new aircraft weapon subsystems, excluding missiles.

BASIS FOR FY 1978 RDTE REQUEST: The Lightweight Launcher for the 2.75 inch rocket and the fixed range and the remote set fuze screening smoke rocket warhead will continue development. Engineering development will begin for the remote set fuze multi-purpose submunition warhead, the improved 2.75 inch rocket motor, and the XM788/789 30 millimeter ammunition.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: New starts in Engineering Development are the improved 2.75 inch rocket motor, the submunition warhead, and the 30mm XM788/789 ammunition.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

Budget Activity #4 - Tactical Programs

Program Element #6.42.02.A

Title Aircraft Weapons

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 42   | 0           | 42    |
| (2) Contractor Employees   | 8    | 0           | 8     |
| Total                      | 50   | 0           | 50    |

DETAILED BACKGROUND AND DESCRIPTION: This program supports the development and test of new gun and rocket aircraft weapon sub-systems. The requirement is for reliable, low cost, easily maintainable, minimum drag, lightweight armament subsystems of advanced design. The program contains two projects: Aircraft Gun Type Weapons (0133) and Aircraft Rocket Subsystems (DL62).

RELATED ACTIVITIES: Close liaison is maintained with the other military services and industry to avoid duplication of effort. The Army participates in the Tri-Service Joint Technical Coordinating Group for Air-Launched Non-Nuclear Ordnance, an organization chartered at the major field command level. This group provides a medium for exchange of technical information and determination of joint use implications. An Army representative serves on the Air Munitions Requirements and Development Committee, an organization within the Office of the Secretary of Defense. One of the functions of this committee is the establishment of joint service requirements and development of air munitions. Related Program Elements are 6.42.07.A, Advanced Attack Helicopter; 6.42.12.A, COBRA/TOW; 6.42.03.A, Aerial Scout; 6.32.06.A, Aircraft Weapons; and 6.22.01.A, Aircraft Weapons Technology.

WORK PERFORMED BY: US Army Armament Research and Development Command (AARADCOM), Dover, NJ; AARADCOM, Edgewood, MD; US Army Armament Research and Development Command, Rock Island, IL; Lake City Ammunition Plant, Lake City, MO; US Army Missile Research and Development Command, Huntsville, AL; Naval Ordnance Station, Indianhead, MD; Hughes Helicopters, Canoga Park, CA; Thiokol Corporation, Brigham City, UT.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Developed and standardized: 7.62mm suppressive fire subsystems for the OH-13, OH-23, TH-1B, TH-1C, TH-1D and CH-47 Helicopters; 2.75 inch rocket systems for the TH-1B, TH-1C and AH-1G; a first generation hard point target missile system for the TH-1B (M-22); a 40mm grenade launcher system for the TH-1B and TH-1C; a new improved 7.62mm machine gun for all systems; and a super-quick fuze for the 2.75 inch rocket. Developed: an improved 7.62mm machine gun and a 40mm grenade suppressive system for the OH-6A; illuminating flare and dispenser system for helicopters; and a 20mm automatic gun system for the AH-1G. Completed development of the proximity fuze for the 40mm grenade and 2.75 inch rocket. Developed an integrated fire control system utilizing moving target indicator radar for long-range target detection and forward looking infrared for target identification and engagement and 19-tube and 7-tube, repairable, reusable 2.75 inch aerial rocket launchers. Development of 30mm ammunition with aluminum case cartridge, XM-140 30mm automatic gun turret, and XM-129 40mm grenade launcher was completed. Initiated development of: the Aerial Scout (including a day/night vision) sighting system; and added navigation capability and laser rangefinder/designator; and an improved survivability aspects for installation on the Light Observation

Budget Activity #4 - Tactical Programs

Program Element #6.42.02.A                      Title Aircraft Weapons

- Helicopter. Completed the 70W installation on the AH-1G. A Data Acquisition Test (DAT) to acquire data on the performance characteristics and operational parameters of the XM188 and XM230, the two candidate 30mm cannons for the Advanced Attack Helicopter (AAH), was completed. In the interest of achieving commonality, the XM714 fuze originally designed for the 20mm will be adapted to the 30mm round. Efforts for weight reduction and icing qualification for the AH-1G were completed.
2. FY 1977 Program: The development of the lightweight launcher will continue as the initial test hardware is fabricated. The fixed range fuze screening smoke warhead will be type classified (XM259). The XM788/789 30mm ammunition will enter Engineering Development.
3. FY 1978 Planned Program: Final test hardware will be fabricated for the Lightweight Launcher and Engineering Design completed. Development of the R/S XM264 Screening Smoke Warhead will continue. Engineering development for the XM261 Multipurpose Submunition Warhead and for Product Improvement of the 2.75 inch rocket motor will begin. The XM788/789 ammunition will continue development and complete commonality testing in FY 1979. The FY 1978 increased funding is for procurement of hardware for the new starts.
4. FY 1979 Planned Program: The Lightweight Launcher will be type classified and Low Rate Initial Production initiated to verify the Design to Unit Production Cost (DTUPC) goal. Development tests for the R/S XM261 Multipurpose Submunition Warhead and R/S XM264 Smoke Warhead will be initiated. Hardware will be fabricated for continued Engineering Development of the R/S XM262 Illumination Warhead. Testing of the Product Improved Motor will continue. The XM788/789 millimeter ammunition will complete Development Test III. Completion of the Lightweight Launcher and the 30 millimeter ammunition development is reflected by the decrease in funding.
5. Program to Completion: The XM264 Screening Smoke Warhead and XM262/XM263 Illumination Warheads will complete final tests and be type classified in FY 1981. Product Improvement of the Improved Rocket Motor will be completed in FY 1981. The XM261 Multipurpose Submunition Warhead will complete final testing in FY 1981 and be type classified. The Reference Marker Warhead will enter Engineering Development in FY 1980. The XM788/789 ammunition will be type classified in FY 1980.



#### Budget Activity #4 - Tactical Programs

#### Title Aircraft Weapons

#### Program Element #6, 42, 02, A

#### TEST AND EVALUATION DATA:

1. Development Test and Evaluation: Development Test (DT I) for the fixed range screening smoke warhead (XM259) for the 2.75 inch rocket was completed at Aberdeen Proving Ground, Maryland. Prototype Qualification Development Test (DT II) for the XM259 was completed by the contractor US Army Armament Research and Development Command (ARRADCOM), Edgewood, Maryland, in June 1976 and will be followed by type classification in early FY 1978. Prototype qualification type (DT II) for the remote set fuze screening smoke warhead (XM264) will be initiated by the Test and Evaluation Command (TECOM) at Yuma Proving Ground (YPG) in 1980 DT II for the improved fixed range illumination warhead (XM263) will begin in late FY 1979 at YPG by TECOM, DT II for the remote set fuze illumination warhead (XM262) will be initiated by TECOM at YPG in FY 1980. The developer, ARRADCOM, Dover, NJ, will start DT I on the remote set fuze multi-purpose submunition warhead (XM264) at YPG in May 1977. DT II will be initiated by TECOM in mid-FY 1979 at YPG. DT II for the lightweight launcher for the 2.75 inch rocket will be conducted by the developer, Hughes Aircraft, at Hughes' test facilities in California and Arizona beginning Nov 1976. Government portions of DT II will be conducted by TECOM at YPG beginning in July 1977. Design verification test for the 2.75 inch rocket motor (DT II type test) Production Improvement Program (PIP) will be conducted in FY 1980 by TECOM at YPG.

2. Operational Test and Evaluation: Operational Test (OT I) of the 2.75 inch Rocket Multipurpose Submunition Warhead will be conducted by United States Army Aviation Test Board (USAAVNB) at Yuma Proving Ground (YPG) during May 1977. United States Army Aviation Center (USAAVNC) will provide an independent evaluation. OT I for submunition warheads will be conducted by USAAVNB at YPG in FY 1977. OT II for the screening smoke warhead will be conducted by USAAVNB in April 1978 at Fort Rucker, AL. USAAVNB will conduct OT II for the Lightweight Launcher and Illumination Warhead at YPG in FY 1978. USAAVNC will provide independent evaluations on all OT conducted by USAAVNB. All systems of the Aircraft Rocket Subsystem will have a Development Acceptance In-Process Review prior to the production decision.

#### 3. Systems Characteristics:

##### Operational/Technical Characteristics

##### Smoke Warheads

Weight, Total  
Weight, Warhead  
Range  
System Reliability  
Area Coverage

##### Objectives

23 lbs.  
10 lbs.  
500-6000 meters  
95%  
3 Hectares (19 rockets)  
698

##### Demonstrated Performance

20.4 lbs.  
8.5 lbs.  
800-2500 meters 1/  
95%  
3 Hectares (14 rockets)



Budget Activity #4 - Tactical Programs

Program Element #6,42,02,A

Title Aircraft Weapons

Demonstrated  
Performance

Operational/Technical  
Characteristics

Objectives

Illumination Warheads

Weight, Total  
Weight, Warhead  
Range  
System Reliability

23 lbs.  
10 lbs.  
1500-6000 meters  
95%

2/  
2/  
2/  
2/

Multi-Purpose Submunition Warhead

Weight, Total  
Weight, Warhead  
Range  
Warhead Reliability

27 lbs.  
14 lbs.  
1000-6000 meters  
3/

27.4 lbs.  
14.4 lbs.  
2500 meters 1/  
3/

Lightweight Launcher

Weight, Total  
System Reliability  
Reload Time

90 lbs.  
97%  
5-10 min 2/

82 lbs.  
2/  
2/

Improved Rocket Motor

Weight, Total  
Range  
System Reliability  
Ballistic Dispersion Firing From Hover  
Elevation  
Azimuth

13 lbs.  
6000 meters  
2/  
14 miles  
10 miles

- 1/ Fixed range fuze only.  
2/ To be determined during DT II/OT II.  
3/ Reliability to be defined and quantified.

FY 1978 RITE DESCRIPTIVE SUMMARY

Program Element #6.42.02.A

Title Aircraft Weapons

Project #DL62

Title Aircraft Rocket Subsystems

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: This project began in FY 1976 as a combination of three related projects. It combines the efforts of the former Advanced Development project, DK62, Selective Effects Armament Subsystems (SEAS); the former Engineering Development project, DI34, Aircraft Missiles and Rockets; and the Engineering Development project, DI24 that supported fire control development. Combining the rocket development with the fire control efforts was a concerted attempt to produce a complete system for the AH-1G/S. Further efforts to streamline the management of this project, as it is a system for the AH-1S, transferred the fire control program to Program Element (PE) 6.42.12.A, COBRA/TOW, in FY 1977. This project will be devoted to the 2.75 inch Rockets and Associated Subsystem Development.

RELATED ACTIVITIES: This project continues the improvement of the 2.75 inch Folding Fin Aerial Rocket (FFAR) under the management of the Tri-Service 2.75 inch FFAR Program Manager's Office. This program is related to PE 6.42.12.A, COBRA/TOW and PE 6.42.07.A, Advanced Attack Helicopter.

WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; US Army Missile Research and Development Command, Huntsville, AL; Naval Ordnance Station, Indianhead, MD; ARRADCOM, Edgewood, MD; Thiokol, Huntsville, AL; Hughes Aircraft Company, Canoga Park, CA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: A product improvement program for a turret capable of accepting a 7.62mm, 20mm, or 30mm gun for integration on the AH-1S COBRA/TOW Helicopter began in FY 1976 and has subsequently been transferred to PE 6.42.12.A, COBRA/TOW, in FY 1977. Development of a lightweight rocket launcher for the Advanced Attack Helicopter (AAH) and the COBRA/TOW Helicopter was initiated in FY 1976. Screening smoke warhead for the 2.75 inch rocket began development in FY 1977.
2. FY 1977 Program: Productivity Engineering and Planning (PEP) will be initiated for the Lightweight Launcher. System integration and cost effectiveness analysis will be updated and trade-offs in weight, reusability, and cost finalized. Additionally, a development plan for the Lightweight Launcher will be prepared and initial hardware for testing fabricated.

Budget Activity #4 - Tactical Programs

Program Element #6.42.02.A

Project #DL62

Title Aircraft Weapons

Title Aircraft Rocket Subsystems

3. FY 1978 Planned Program: Engineering design for the Lightweight Launcher will be completed. Development of the Remote Set (R/S) XM264 Screening Smoke Warhead will continue. Initial assembly of the R/S XM264 will allow Government Engineering tests to commence. The R/S XM261 multipurpose submunition warhead will begin development by procuring long lead items and initiating Producibility Engineering and Planning. Cost effectiveness analysis for design configuration and system integration will also begin for the XM261. The Product Improvement Program on the 2.75 inch rocket motor utilizing the technology from the Navy Mark 66 motor will commence with a design effort and hardware fabrication. Included in the effort will be the selection of a fin and nozzle assembly which will provide increased rocket accuracy when fired from a hover. The increase in funding is for procurement of hardware for the new starts in Engineering Development.
4. FY 1979 Planned Program: The Lightweight Launcher will be type classified and enter Low Rate Production. Hardware will be fabricated for the R/S XM264 Screening Smoke Warhead and the R/S XM261 Multipurpose Submunition Warhead and development tests initiated. The R/S XM262 Illumination Warhead begin development. The improved rocket motor will continue development.
5. Program to Completion: The R/S XM264 screening smoke warhead and XM262/XM263 Illumination Warheads will complete final tests and be type classified in FY 1981. The improved rocket motor will complete the product improvement program in FY 1981. The R/S XM261 multipurpose submunition warhead will complete final testing and be type classified in FY 1981. The Reference Marker Warhead will enter Engineering Development in FY 1980.

RESOURCES: (\$ in Thousands)

|              | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional to Completion</u> | <u>Total Estimated Cost</u> |
|--------------|----------------|----------------|----------------|----------------|---------------------------------|-----------------------------|
| ROUTE: Funds | 2638           | 1930           | 5144           | 5323           | Continuing                      | Not Applicable              |
| Quantities   | 0              | 0              | 3625           | 4725           | Continuing                      | Not Applicable              |

FY 1978 ROUTE DESCRIPTIVE SUMMARY

Program Element #6.42.02.A

Title Aircraft Weapons

Project #D133

Title Aircraft Gun Type Weapons

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: This program supports the development and test of the ADEN/DEFA type ammunition for the Advanced Attack Helicopter (AAH). The requirement is for a 30mm dual purpose round that is interoperable with ADEN/DEFA ammunition used by US Marines and by NATO countries. Prior efforts were aligned to development of the Weapons Command (WECOM) 30 ammunition for the AAH, but a decision by the Office of the Secretary of Defense (OSD) during 1976 directed the Army to convert to the more widely used ADEN/DEFA type ammunition. This round provides comparable effectiveness to the WECOM 30 (XM552), while demanding AAH performance trade-offs due to increased weight.

RELATED ACTIVITIES: Close liaison is maintained with the other military services and industry to avoid duplication of effort. The Army participates in the Tri-Service Joint Technical Coordinating Group for Air-Launched Non-Nuclear Ordnance, an organization chartered at the major field command level. This group provides a medium for exchange of technical information and determination of joint use implications. An Army representative serves on the Air Munitions Requirements and Development Committee, an organization within the Office of the Secretary of Defense. One of the functions of this committee is the establishment of joint service requirements and development of air munitions. Related Program Elements are 6.42.07.A, Advanced Attack Helicopter; 6.42.12.A, COBRA/TOW; 6.32.06.A, Aircraft Weapons; and 6.22.01.A, Aircraft Weapons Technology.

WORK PERFORMED BY: US Army Aviation Research and Development Command, St. Louis, MO; US Army Armament Research and Development Command, Rock Island, IL; Lake City Ammunition Plant, Lake City, MO; US Army Missile Research and Development Command, Huntsville, AL; Hughes Helicopters, Culver City, CA; General Electric, Burlington, VT; and Fairchild, Syosset, NY.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Developed and standardized: 7.62mm suppressive fire subsystems for the OH-13, OH-23, TH-1B, UH-1C, UH-1D, and CH-47; and a new improved 7.62mm machine gun for all systems. Developed: an improved 7.62mm machine gun and a 40mm grenade suppressive system for the OH-6A; and a 20mm automatic gun system for the AH-1G. Development of a 30mm aluminum case cartridge, XM-140 30mm automatic gun turret, and XM-129 40mm grenade launcher was completed. Continued the improvements to the XM-522 30mm cartridge to include the improved fuze sensitivity at low graze angles, and increased range for optimum armor penetration. A Data Acquisition Test (DAT) to acquire data on the performance characteristics and operational parameters of the XM188 and XM230, the two candidate 30mm cannons for the AAH was completed. The XM714 fuze was subjected to range

Budget Activity #4 - Tactical Programs

Program Element #6.42.02.A

Title Aircraft Weapons

Project #D133

Title Aircraft Gun Type Weapons

and acceptance testing. Full scale development of this fuze commenced in 1977 and fuzes were contracted for delivery in FY 1977. The XM579 fuze development, as a back-up for the XM714, was continued, with an In-Process Review scheduled for early FY 1977 to determine if the XM714 would satisfy ADEN/DEFA type ammunition requirements.

2. FY 1977 Program: A contract will be awarded to the Advanced Attack Helicopter (AAH) gun contractor for development of the total ADEN/DEFA type round of ammunition, now designated XM788 (TP or training) and XM789 (High Explosive, Dual Purpose, or HEHP). As support for this contractual effort, the aluminum case will be evaluated for this higher impulse round, and the XM714 fuze will continue in development. Both fluted and shallow cone liners will be considered for the warhead during the contractual phase.

3. FY 1978 Planned Program: Contractual efforts on the development of the XM788 and XM789 rounds will continue. Initial deliveries of ammunition for AAH testing will commence this year, and the funding increase over FY 1977 results from the requirement for large quantities of testing ammunition necessary for type classification.

4. FY 1979 Planned Program: The major part of the development program will be finished by the end of this year. Final quantities of test ammunition will be delivered by the contractor prior to type classification in FY 1980. The funding level decreases as the development is completed.

5. Program to Completion: Type classification of the XM788 and XM789 ammunition will be accomplished in FY 1980 and this program will be effectively completed by the end of that year.

RESOURCES: (\$ in Thousands)

| RDTE: Funds | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion |      | Total Estimated Cost | Not Applicable |
|-------------|---------|---------|---------|---------|--------------------------|------|----------------------|----------------|
|             |         |         |         |         | Continuing               | 5400 |                      |                |
|             | 2127    | 735     | 10622   |         |                          |      |                      |                |



FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.42.04.A

Title Air Mobility Support Equipment

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number         | Title                                   | FY 1976 | FY 1977 | FY 1978 | FY 1979                              | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|------------------------|---|---------|---------|---------|--------------------------------------|-------------------------------------|-------------------------------------|
|                        | TOTAL FOR PROGRAM ELEMENT               | 3738    | 1475    | 7515    | 6928                                 |                                     |                                     |
| DC32                   | Ground Support Equipment                | 115     | 110     | 100     | 528                                  | Continuing                          | Not Applicable                      |
| DC33                   | Cargo Handling Equipment                | 233     | 165     | 452     | 350                                  | Continuing                          | Not Applicable                      |
| D275                   | Synthetic Flight Training System (SFTS) | 2876    | 1100    | 6156    | 5100                                 | Continuing                          | Not Applicable                      |
| D279                   | Airdrop Equipment Development           | 514     | 100     | 807     | 950                                  | Continuing                          | Not Applicable                      |
| Procurement:           |   |         |         |         |                                      |                                     |                                     |
|                        | Funds                                   | 19100   | 0       | 8200    | 85100                                | Continuing                          | Not Applicable                      |
|                        | Quantities (SFTS)                       | 6(2B24) | 0       | 2(2B24) | 5(2B24)<br>2(2B31)<br>3(2B33)2(2B38) |                                     |                                     |
| Military Construction: |   | 2880    | 3874    | 1971    | To be Determined                     |                                     |                                     |

BRIEF DESCRIPTION OF ELEMENT: This program element develops items of equipment, excluding aircraft, that support the Army air mobility concept and prototype equipment. This program leads to the production of the item to support the aircraft fleet, or is directly applicable to the aircraft. The SFTS enhances the operational and cost effectiveness of flight training from a standpoint of personnel effectiveness, reduces flight time required to meet operator "proficiency requirements" and increases mission performance. The airdrop equipment program is designed to improve operational capability, maintainability, and reliability of equipment and related items.

Budget Activity #4 - Tactical Programs

Program Element #6.42.04.A

Title Air Mobility Support Equipment

BASIS FOR FY 1978 RDTE REQUEST: Ground Support Equipment (GSE). The Utility Tactical Transport Aircraft System (UTTAS) Synthetic Flight Training System (SFTS) prototype development will continue and the Advanced Attack Helicopter (AAH) SFTS prototype development will begin. Components of the Low Altitude Parachute Extraction System (LAPES), will be improved, an interim High Altitude Equipment Delivery System will be developed and the multiple use airdrop platform will be redesigned and evaluated. External cargo handling nets and slings will be evaluated and type classified.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The bulk of the 2B38 Utility Tactical Transport Aircraft System (UTTAS) Synthetic Flight Training Systems (SFTS) prototype development funds are expended in FY 1977 and FY 1978. These funds are required to insure the future fielding of a production 2B38 concurrent with the fielding of the UTTAS aircraft.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 28   | 0           | 28    |
| (2) Contractor Employees   | 97   | 89          | 186   |
| Total                      | 125  | 89          | 214   |

DETAILED BACKGROUND AND DESCRIPTION: The ongoing Program Element (P.E.) combines the past efforts of ground support equipment development, airdrop and cargo handling developments, and Synthetic Flight Training System (SFTS) prototype development to enhance the operational effectiveness of current and future aircraft systems. The objective of this P.E. is to improve existing hardware, develop and evaluate prototype equipment and type classify the acceptable hardware. The ground support equipment project studies, evaluates, and develops equipment applicable to the servicing and maintenance of aircraft. The aerial delivery and cargo handling project develops slings and nets to optimize helicopter transportation of supplies and parachutes for the airdrop of personnel and equipment by United States Air Force aircraft. The SFTS project develops helicopter flight and operational training simulation devices for present and future aircraft. The SFTS project is designed to produce a safe, cost effective means of improving aviator proficiency.

RELATED ACTIVITIES: Program Elements 6.32.09, Air Mobility Support; 6.22.09, Aeronautical Technology; 6.27.27.A, Non-System Training Device Technology; and 6.22.10.A, Airdrop Technology, in coordination with the Joint Technical Coordinating Group/Airdrop and the Joint Air Movements Board and North Atlantic Treaty Organization Standardization agreements.

**Budget Activity #4 - Tactical Programs**

Program Element #6.42.04.A

Title Air Mobility Support Equipment

WORK PERFORMED BY: Brooks and Perkins, Inc., Pioneer Recovery Systems, Manchester, CT; Boeing-Vertol, Philadelphia, PA; US Army Natick Research and Development Command, Natick, MA; US Army Aviation Research and Development Command, St. Louis, MO; The Project Manager Training Devices, Orlando, FL; and Naval Equipment Training Center, Orlando, FL.

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. FY 1977, FY 1976, and Prior Accomplishments: Developed self-propelled crane, aircraft weapons loader and type classified aircraft maintenance trailer, heavy airdrop system, cargo parachute ground release, steerable personnel parachute, and low-cost cargo parachute. Type classified the aircraft aerial recovery kit, platform extraction force transfer coupling, C-5A airdrop equipment, universal drive-off aid (airdrop loads) and improved parachute harness. Completed studies of helicopter ground movement systems. Evaluated the active arm external load stabilization system with increased aircraft load carrying performance envelope for air-speed, instrument flight and time to acquire and emplace loads. Completed the prototype fabrication of the Automatic Inspection Diagnostic and Prognostic Equipment for the UH-1 Aircraft. Continued the fabrication of the CH-47 and AH-1 (COBRA) Synthetic Flight Training System (SFTS). Initiated development of the Utility Tactical Transport Aircraft System (UTTAS) prototype simulator. Initiated improvement of Low Altitude Parachute Extraction System (LAPES) components, extraction parachutes, and airdrop platform design. Type classified the G-11B parachute for low level airdrop of loads up to 15,000 pounds. Develop an interim high level airdrop container system (IHLCADS) to satisfy the Unified Command's contingency requirements. Continued development of Joint Service airdrop platforms, external cargo slings, and the top lift device for handling containers.
2. FY 1977 Program: Continue evaluation of off the shelf items for ground support of helicopters. Type classify the 2B31 (CH-47 Helicopter) and 2B33 (AH-1 COBRA) SFTS and continue development on the 2B38 (UTTAS) SFTS. Evaluate night visual research simulator and a higher order computer language for simulation devices. Type classify the family of nets and slings for use with aircraft now being developed. Continue development of a top lift device for containers. Initiate development of a high speed helicopter hoist for the UH-1 and UTTAS. Extend LAPES to include newly developed combat/combat support equipment. Finalize engineering on the high altitude equipment delivery system (interim) and the Type V multipurpose joint service airdrop platform.
3. FY 1978 Planned Program: Ground Support Equipment: Compatibility studies of Army equipment for UTTAS will be initiated. Continue development of the UTTAS and initiate development of the Advance Attack Helicopter prototype simulator. Type classify the high performance helicopter hoist. Type classify and initiate procurement on external slings and nets. Type classify top-lift device for containers, IHLCADS, and the multipurpose Joint Service Type V airdrop platform. Complete improvement of Low Altitude Parachute Extraction System (LAPES) components. Majority of increase in funding from FY 1977 to FY 1978 is for the UTTAS SFTS to allow fielding of the production model concurrent with the UTTAS Helicopter.

Budget Activity #4 - Tactical Programs

Program Element #6.42.04.A

Title Air Mobility Support Equipment

4. FY 1979 Planned Program: Ground Support Equipment: Evaluate equipment found to be militarily adaptable from the civilian market and test for use for the Utility Tactical Transport System (UTTS) and Advanced Attack Helicopter (AAH). Complete development of UTTS and continue development of the AAH Simulator.
5. Program to Completion: This is a continuing program.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.42.04.A

Title Air Mobility Support Equipment

Project #D275

Title Synthetic Flight Training System (SFTS)

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The Synthetic Flight Training System (SFTS) is an advanced state-of-the-art aviation training device. The SFTS has demonstrated that it can reduce costs to accomplish certain requisite training and also provide an atmosphere in which training activities heretofore prohibited during actual flight can be accomplished. The first simulator developed under this program was the 2B24 (UH-1 Helicopter) Instrument Trainer. It was type classified standard by the Army in June 1972. Because of the design of the SFTS it is possible to insure exact standardization of training. The computer capability ensures that each student receives the same instruction and is objectively graded on their performance. Demonstration of certain emergency procedures which will minimize loss of life and equipment are now possible. Current and future developments include visual systems capability. These simulators consist of an instructor station, trainee station and a computer complex. The instructor station consists of an extensive array of display equipment presenting to the instructor information relative to the status of each student. Control features permit the instructor to monitor the activities and progress of each student, introduce failure situations, alter flight parameters, or modify instructions. The student station consists of a model of the cockpit of the aircraft being simulated and a five or six degree of motion platform. The computer complex provides the means to simulate all flight parameters and communications. It permits presenting standardized instruction to each student and provides the means for measuring student performance objectively.

RELATED ACTIVITIES: The Project Manager for Training Devices and the US Army Training Device Agency maintain liaison with the other services and industry to include foreign countries. Those agencies monitor all training devices developed by the Army. Program Element (P.E.) 6.32.09.A Air Mobility Support, P. E. 6.42.06.A, Utility Tactical Transport System, P. E. 6.42.07.A, Advanced Attack Helicopter and P. E. 6.42.03.A, Advanced Scout Helicopter.

WORK PERFORMED BY: US Army Training Device Agency, Orlando, FL; US Army Aviation Research and Development Command, St. Louis, MO; Singer Link Corporation, Binghamton, NY, other contractors to be determined.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments:

- a. Completed development of the SFTS 2B24 (UH-1) instrument flight simulator and initiated development of the 2B31 (CH-47 Helicopter) and 2B33 (AH-1 Helicopter) simulators that were initiated in FY 1973, both systems contain a visual system.



**Budget Activity #4 - Tactical Programs**

Program Element #6.42.04.A

Project #D275

Title Air Mobility Support Equipment

Title Synthetic Flight Training System (SFTS)

2. FY 1977 Program: Complete fabrication, component integration and development testing of the 2B31 (CH-47 Helicopter) and 2B33 (AH-1 Helicopter) simulators for simulator delivery and installation at Ft. Rucker, AL. Conduct operational testing of 2B31 (CH-47) and 2B33 (AH-1) simulators. Type classify the 2B31 (CH-47) and 2B33 (AH-1) simulators. Initiate development of the 2B38 Utility Tactical Transport Aircraft System (UTTAS) SFTS prototype.

3. FY 1978 Planned Program: Continue development of the UTTAS SFTS. Initiate design of the 2B40 Advanced Attack Helicopter (AAH) simulator. Increase of FY 1978 program over FY 1977 due to funds required for both the 2B38 and 2B40 having sophisticated simulation requirements, i.e., the wide angle visual system for nap-of-the-earth flight simulation, and the 2B40 requires simulation of weapons and fire control systems.

4. FY 1979 Planned Program: Complete the development test and type classify the UTTAS SFTS prototype. Continue development of the AAH 2B40 SFTS. FY 79 funding is less than FY 78 due to completion of R&D on 2B31 and 2B33 and majority completion on the 2B38.

5. Program to Completion: This is a continuing program.

5. Major Milestones:

|                                  | <u>Date</u> | <u>Estimated RDTE Cost to<br/>Reach Events (Cumulative)</u> |
|----------------------------------|-------------|---|
| a. Type Classify UTTAS SFTS 2B38 | 1QFY79      | 10,000  |
| b. Type Classify AAH SFTS 2B40   | 4QFY82      | 14,457  |

Budget Activity #4 - Tactical Programs

Program Element #6.42.04.A

Project #D275

RESOURCES: (\$ in Thousands)

Title Air Mobility Support Equipment

Title Synthetic Flight Training System (SFTS)

|             | FY 1976 | FY 1977 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost | Not Applicable |
|-------------|---------|---------|---------|---------|---------|--------------------------------|----------------------------|----------------|
| RDTE: Funds | 2876    | 1100    | 5391    | 6156    | 5100    | Continuing                     |                            | Not Applicable |

Quantities (1 2B31 (CH-47) & 1  
2B33 (AH-1))  
(1 2B38 (UTTAS) & 1  
2B40 (AAH))

Procurement

|                           |       |   |       |      |       |       |       |  |
|---------------------------|-------|---|-------|------|-------|-------|-------|--|
| Funds                     | 19100 | 0 | 14500 | 8200 | 21600 |       | 90100 |  |
| Quantities (2B24 (UH-1))  | 6     | 0 | 4     | 2    | 5     |       | 28    |  |
| Funds                     | -     | - | -     | -    | 16400 | 8400  | 24800 |  |
| Quantities (2B31 (CH-47)) | -     | - | -     | -    | 2     | 1     | 3     |  |
| Funds                     | -     | - | -     | -    | 32700 | 22600 | 55300 |  |
| Quantities (2B33 (AH-1))  | -     | - | -     | -    | 3     | 2     | 5     |  |
| Funds                     | -     | - | -     | -    | 14400 | 56600 | 71000 |  |
| Quantities (2B38 (UTTAS)) | -     | - | -     | -    | 2     | 7     | 9     |  |

Military Construction:

2808  
2B24 Locations FY 77 - Ft Eustis, VA; Ft Ord, CA; Ft Sill, OK; Ft Belvoir, VA; FY 78 - Ft Carson, CO, Ft Wainwright, Alaska;  
FY 79 - Ft Campbell, KY, Europe, Ft Polk, LA; Ft Sam Houston, TX; Ft Bliss, TX; or at Ft Rucker,  
AL (Subject to Cost Effectiveness Analysis for each location).

2B31-2B33-2B38 Locations: FY 79 - 2B31 Ft Campbell KY and Europe. FY 79 - 2B33 Ft Hood TX, Europe (2). 2B38 FY 79 -  
Ft Campbell, Ky and Ft Bragg, NC.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTTAS)

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                     | FY 1976 | FY 1977 | FY 1977 * | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---------------------------|---------|---------|-----------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT | 93672   | 18658   | 75456     | 34837   | 2985    | 0                        | 465301               |
|                | Quantities                | 0       | 0       | 0         | 0       | 0       | 0                        | 10                   |
| D189           | UTTAS Engine              | 8149    | 1357    | 5192      | 3255    | 0       | 0                        | 70269                |
| D378           | UTTAS                     | 85523   | 17301   | 70264     | 31582   | 2985    | 0                        | 395032               |
| Procurement:   |                           |         |         |           |         |         |                          |                      |
|                | Funds                     | 0       | 0       | 13750     | 236200  | 373500  | 2190000                  | 2937080              |
|                | Quantities                | 0       | 0       | 15        | 56      | 129     | 907                      | 1107                 |

BRIEF DESCRIPTION OF ELEMENT: The Utility Tactical Transport Aircraft System (UTTAS) is a new twin engine helicopter that will replace the UH-1 helicopter in the air assault, air cavalry and med-evacuation mission. This new aircraft will be designed to be the Army's first true squad assault helicopter. The UTTAS is designed to perform the missions of transporting troops and equipment into combat, resupplying the troops while in combat and performing associated functions of aeromedical evacuation, and repositioning of reserves.

BASIS FOR FY 1978 RDTE REQUEST: RDTE prototypes of the selected UTTAS will continue to be updated to correct any deficiencies resulting from the Government Competitive Tests, and efforts will be continued to mature the UTTAS towards achieving Reliability and Maintainability Goals. Testing will be continued on the Ground Test Vehicle to achieve an additional 700 hours of testing. Testing rating. Maturity phase testing of the prototypes will be continued for final aircraft survey and demonstration testing. The second increment Production Aircraft will be used to equip elements of the 101st Airborne Division towards achieving the Initial Operational Capability date. The GE T-700 Engine Development will be concluded with the maturity testing toward achieving the 1200 hour Meantime Between Failure goal.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The funding in FY 1978 decreased in accordance with planning towards contractor completion of the Maturity Phase of the development program as effort increases in the procurement and production investment phase.

**Budget Activity #4 - Tactical Programs**

Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTTAS)

**PERSONNEL IMPACT:**

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

**TERMINATION COST:** (\$ in Thousands) 1 Oct 77

|                            | RDTE | PROCUREMENT | TOTAL |                          | FY 1977<br>and<br>Prior | FY 1978 | Total   |
|----------------------------|------|-------------|-------|--------------------------|-------------------------|---------|---------|
| (1) Federal Civ. Employees | 51   | 0           | 51    | (1) Estimated Government | 427479                  | 4472000 | 4899479 |
| (2) Contractor Employees   | 763  | 1282        | 2045  | liability Financed       |                         |         |         |
|                            |      |             |       | with:                    |                         |         |         |
| Total                      | 814  | 1282        | 2096  |                          |                         |         |         |

**DETAILED BACKGROUND AND DESCRIPTION:** The UTTAS program started with the stated development objectives of both an airframe and engine in 1965. Concept formulation studies were conducted in 1967 to define the required performance parameters for primary and secondary missions. The primary mission is assault delivery of troops and supplies, with aeromedical evacuation as secondary. The UTTAS will be the Army's first true squad carrying helicopter. The UTTAS is designed to replace the UH-1 helicopter in assault helicopter air cavalry and aeromedical evacuation units. It provides a follow-on helicopter with increased payload and substantially improved reliability, maintainability, survivability, crashworthiness and performance. The UTTAS, with a crew of three, will be capable of transporting 11 combat equipped troops, or an equivalent payload, at 4000 feet pressure altitude, 950 ambient temperature and exhibit the following characteristics, using not more than 95% intermediate rated power of the GE T-700 Engine:

|   |                                       |
|---|---------------------------------------|
| Airspeed (knots, true airspeed)                               | 145-175                               |
| Endurance (hours)   | 2.3                                   |
| Vertical Flight Performance Characteristics (feet per minute) | 450-550                               |
| Armament  | Two medium machine guns               |
| Armor protection  | 7.62mm and redundant critical systems |
| Avionics  | Austere (Improved UH-1 avionics)      |

**RELATED ACTIVITIES:** US Navy and US Air Force requirements have been coordinated with the Army and where appropriate, incorporated into the UTTAS development. The US Navy has initiated action for the Light Airborne Multi-Purpose System (LAMPS) mission and the UTTAS will be considered. A Memorandum of Understanding has been signed by the UTTAS and LAMPS Program Managers.

**WORK PERFORMED BY:** The GE T700 engine development is being conducted by General Electric, Lynn, MA. Airframe development contract is with Sikorsky Aircraft Division, United Technologies, Stratford, CT. Responsibility for the project is vested in the UTTAS Project Manager, US Army Materiel Development and Readiness Command, St. Louis, MO.



Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTTAS)

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. FY 1977, FY 1976 and Prior Accomplishments: From FY 1968, the mission requirements and definition of the aircraft needed for a combat assault utility helicopter to replace the UH-1 helicopter were studied. As a result of these studies, a Systems Development Plan, a Decision Coordinating Paper, Request for Proposals, and a Determination and Findings were prepared. The development program was approved by DOD on 22 June 1971. Request for Quotation for the UTTAS propulsion system was presented to industry on 30 July 1971. The Source Selection Evaluation of the Request for Quotation resulted in General Electric as the engine developer with a development contract signed on 6 March 1972. The aircraft Request for Proposal was presented to industry on 5 January 1972. The Source Selection Evaluation of the proposals submitted by Bell Helicopter Company, Boeing Vertol, and Sikorsky Aircraft resulted in the Secretary of the Army awarding contracts to Boeing Vertol and Sikorsky Aircraft on 30 August 1972. Both airframe contractors completed fabrication of the Ground Test Vehicles and Static Test Articles in FY 1974, and achieved first flight in FY 1975. The Ground Test Vehicle completed over 400 hours of testing and 200 hours of Military Qualification Testing. The Static Test Articles underwent design and static load testing. The airframe contractors completed fabrication of the remaining flyable prototypes and started their Basic Engineering Development flight testing. The GE T700 UTTAS engine successfully completed the 60 Hour Preliminary Flight Rating Test and deliveries of the flight rated engine continued into the 4th quarter FY 1975. Engine cell testing accumulated 5000 hours. The UTTAS contractors advised the Army that they would exceed the funds specified in their cost-plus-incentive-fee development contracts. Under these contracts the Army allowed the Contractors to continue work on the UTTAS after FY 1975 funds had been expended. Cost incurred in excess of the total amount allocated to the contract were incurred at the Contractor's own risk with any additional appropriations in Fiscal Years 1976 and 1977 to be at the discretion of Congress. The Contractors continued spending, accepting the risk, to complete the work schedule for the FY 1975 portion of the program. The FY 1976/77 Army Budget request included sufficient funds to repay the contractors for the FY 1975 efforts. The Congress was advised of the overrun and the Army's Plan for payback. In FY 1976 the Army awarded Producibility Engineering and Planning contracts on 3 September 1975. Early in FY 1976 Boeing Vertol advised the Army of an additional cost growth situation. The Army notified both airframe contractors that additional funds for prototype development would not be made available, but that the contractors would put forth their best efforts to deliver the best UTTAS for Government Competitive Tests within funds remaining on present prototype contracts. The Government Competitive Tests, as a result of an in-flight failure and crash of Boeing Vertol's number one prototype on 19 November 1975, was delayed five weeks and started in March 1976 and continued through November 1976. The GE-T-700 engine continued its development testing with achievement of a 150 hour Military Qualification rating in March 1976. Delivery of flight rated engines was completed in the 2nd quarter FY 1976. The FY 1976 RDT E Budget submission included \$14.2 million for contractors payback for work performed in FY 1975. Funds in the amount of \$1.8 million were reprogrammed from other Army resources to accomplish the cost of repairing the damaged aircraft, engines and schedule adjustments. During FY 1977 period the Army continued with the Government Competitive Testing, started the source selection proceedings and evaluated the accumulated test data in order to select a UTTAS winner. The airframe contractors continued the Producibility Engineering and Planning phase in preparation for initial production. The 300 hour Military Qualification Test Rating was also completed during this period.



Budget Activity #4 - Tactical Programs

Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTAS)

2. FY 1977 Program: The source selection proceedings will be completed and a winning design selected for a production contract award. Maturity phase testing will begin to complete the final aircraft surveys and demonstration testing. The T-700 Production contract is scheduled for award at the same time.

3. FY 1978 Planned Program: The maturity phase testing will focus on completion of the Ground Test Vehicle Military Qualification Tests; Static Test Article Vulnerability reduction demonstration; peculiar support equipment qualifications; main and tail rotor component fatigue testing; full system and miscellaneous component qualification testing; and life support environmental and furnishing tests. In addition, operational, Reliability and Maintainability tests will be continued and Producibility Engineering and Planning effort will be completed in preparation for the full scale production decision scheduled for the 4th Quarter FY 1979. The GE T-700 engine will also complete its maturity testing. Decrease in funding from FY 1977 is due to completion of the major development effort in prior years and concurrent transition into Initial Production.

4. FY 1979 Planned Program: Airworthiness and Flight Characteristics test, conduct of Cold Regions (Arctic Test), Development Test III, and Operational Test III will be completed. The planned R&D effort will be completed. A decision for entry into full scale production will be made in 4th Quarter FY 1979. Decrease in required funding from FY 1978 is due to phase down of R&D effort and increased emphasis on the Production Phase.

5. Program to Completion: This is a continuing program and after completion of the Maturity Phase in September 1978, the RDTE effort remaining will be primarily in the area of verification testing by the Government and completion of Development Test/Operational Test (DT/OT) III. These efforts will be completed in March and April 1979 respectively. All RDTE efforts will be completed in FY 1979.

6. Major Milestones:

|   | Date   | Estimated RDTE Cost to Reach Events (Cumulative) |
|---|--------|--|
| a. Engine Development Contract Award              | Mar 72 | 5700   |
| b. Prototype Development Contracts Awarded        | Aug 72 | 15800  |
| c. First Flight                                   | Nov 74 | 209014   |
| d. Engine Military Qualification Test (150 hours) | Mar 76 | 318429   |
| e. Prototype Evaluation Completed                 | Dec 76 | 366994   |
| f. Production Award                               | Dec 76 | 371081   |
| g. Initial Production Delivery                    | Aug 78 | 459598   |
| h. DT/OT III Completed                            | Apr 79 | 465301   |

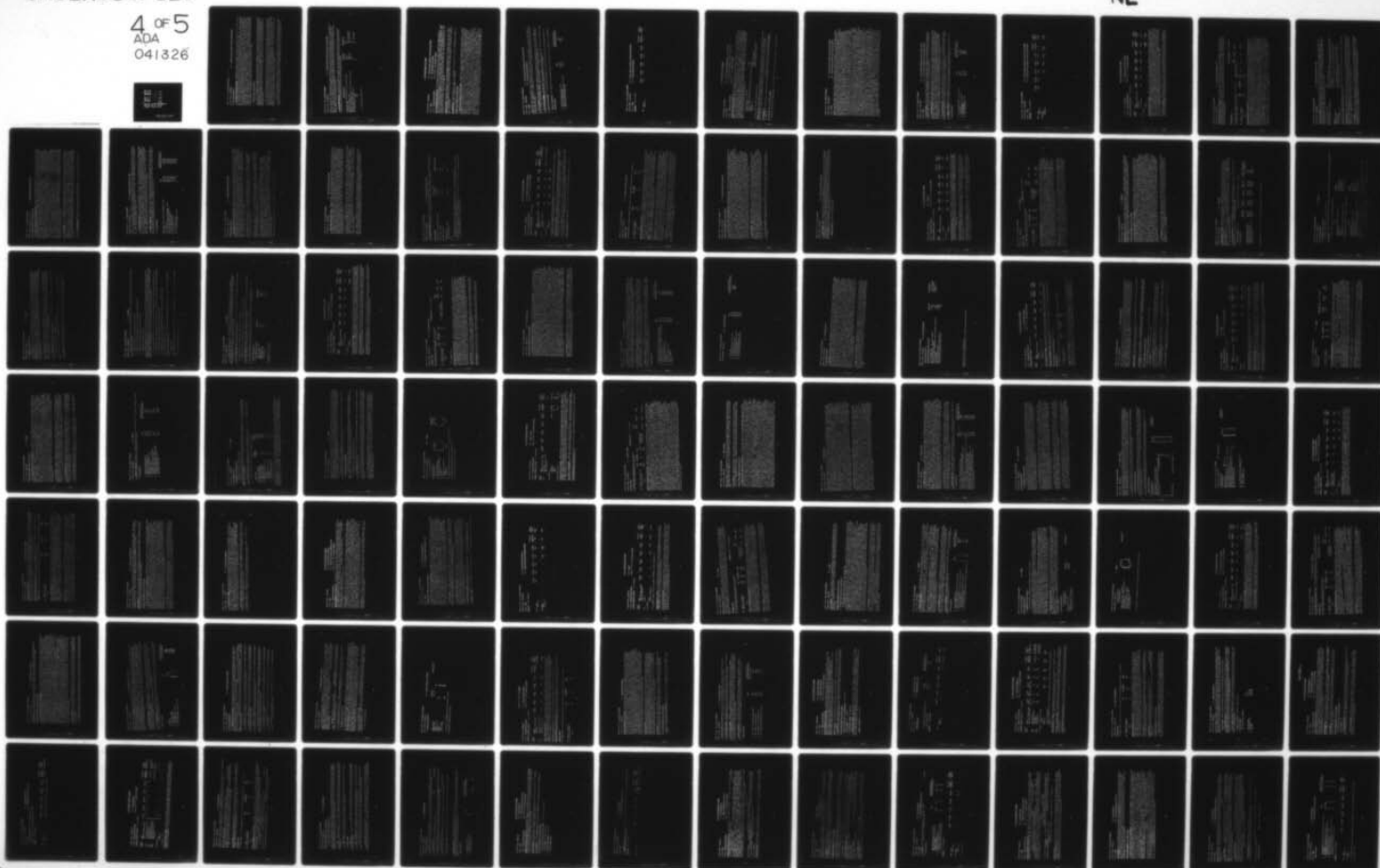
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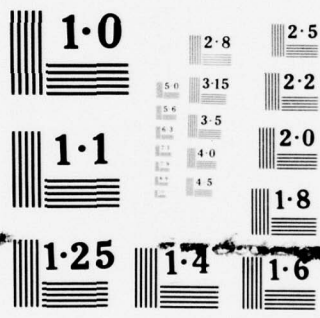
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NATIONAL BUREAU OF STANDARDS  
MICROCOPY RESOLUTION TEST CHART

Budget Activity #4 - Tactical Programs

Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTTAS)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: Engineering development testing of the UTTAS is currently being conducted by General Electric (T-700 GE-700) and Sikorsky (YUH-60A). Contractors have met or exceeded contractual milestones to date. After completing first flight on schedule the contractors have made considerable progress in their flight test program. Development Test (DT) II was conducted during the period of 25 Apr-19 Jun 76 by the Aviation Test Board (FT Rucker) for 165 hours. Also part of DT II was the US Army Aviation Engineering Flight Activity (AEFA) 90 hour flight test occurring from 20 March to 18 September 76. DT II schedule encompassed a total of 385 hours including 130 hours for pilot training. These flight hours, with the exception of the AEFA 90 hours flight test, were Reliability, Availability and Maintainability (RAM) related. The prototype aircraft for both DT and Operational Testing (OT) is basically representative of the configuration to be procured. DT III will be conducted by the US Army Aircraft Development Test Activity (ADTA) in the vicinity of Fort Rucker, AL. Approximately 200 hours will be flown on two production UTTAS. The objectives are: to determine if the production UTTAS and its associated training and maintenance packages continue to meet the specifications and characteristics stated in the requirements document; and to determine the adequacy of modifications intended to correct materiel problems revealed during previous (DT/OT II) testing.

2. Operational Test and Evaluation:

- a. OT II was designed to provide data upon which to make an evaluation of the operational issues pertaining to flight handling characteristics, mission performance, operational availability, reliability, maintainability, survivability, supportability, air transportability and safety. In order to fully evaluate the candidate systems, OT II was conducted in varying terrain conditions and under identical scenarios and weather conditions for each system. Scenarios included all normal missions associated with assault helicopter employment except those associated with aircraft subsystems which were not available during this phase of the development program.
- b. OT II, a two-phased operational test, was conducted by Operational Test and Evaluation Agency (OTEA), to examine the two candidate UTTAS systems manufactured by the Boeing Vertol Company and the United Technologies Corporation, Sikorsky Aircraft Division. Two candidates from each contractor were compared with the UH-1H as a baseline. Phase I (Sep 75 - Jan 76) of the test was conducted at the contractor's facilities at Calverton, NY, Stratford, CT and Lynn, MA. This phase was devoted to training of flight crews and maintenance personnel. Phase II (Jun - Sep 76) tested the candidate systems in an operational environment at Ft. Campbell, KY. Altitude testing was incorporated into Phase II and was conducted in the vicinity of Knoxville, TN. The test unit for OT II consisted of elements of the 101st ABN (Air Assault) Division.
- c. Operational Testing (OT) III is scheduled to be conducted at Ft Campbell, KY (Jan-Mar 1979) under the direction of Operational Test and Evaluation Agency (OTEA) to further evaluate the operational effectiveness, reliability, availability and maintainability of the UTTAS in an operational environment. OT III will be a 10-week test utilizing five production models. New

Budget Activity #4 - Tactical Programs

Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTTAS)

Equipment Training (NET) team personnel will conduct UTTAS training. A total of 500 UTTAS flying hours will be required during the test. The test will be conducted at Fort Campbell, KY, and will consist of a series of trials and extended (3 to 5 days) field exercises. Overall, the system will be tested against a standard of performance established from Operational Testing II test results. Missions will be conducted under varying light and weather conditions and will include administrative, resupply, combat assault, medical evacuation and special operations.

3. Systems Characteristics: Performance is required at Design Gross Weight (approximately 15,000 lbs.), 4000 feet pressure altitude and 95°F ambient temperature conditions. In addition, the Vertical Flight Performance Characteristics (VFPC) is required under zero wind conditions using not more than 95% intermediate rated power.

Characteristics

|   | <u>Objective</u> | <u>Demonstrated</u> |
|---|------------------|---------------------|
| Cruise Speed (max continuous knots true air speed (KTAS))     | 145-175          | 145                 |
| Endurance, hours  | 2.3              | 2.3                 |
| VFPC, feet per minute (FPM)                                   | 450-550          | 450 @ 2850 ft/950 F |
| Maneuver, Ft. (Distance to clear 200 foot object at 150 KTAS) | 1100-1300        | Less than 1100 ft.  |
| Vibration Levels (cockpit g's)                                | .05              | .1                  |
| Vulnerable Area (prime threat) Sq. Ft.                        | 0                | 0                   |
| Air Transportability - C130*                                  | 1                | 1 - using mockup    |
| C141  | 2                | 2                   |
| C5A   | 6                | *                   |

\* To be determined during OT III.



FY 1978 NOTE DESCRIPTIVE SUMMARY

Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTTAS)

Project #D189

Title Aircraft Engine Development

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The program was established to develop an advanced technology turboshaft engine for use in Army Aircraft and particularly for the Utility Tactical Transport Aircraft System (UTTAS). The 1500 shaft horsepower engine has the following significant improvements over current propulsion systems: a 20% reduction in specific fuel consumption; a 30% increase in shaft horsepower to weight ratio and improved reliability and maintainability. It is also designed for use in a high vibration environment at higher internal thermal stresses and rotational cycles while exhibiting improved survivability and less susceptibility to the effects of dust and sand ingestion.

RELATED ACTIVITIES: The engine design specifications were informally coordinated with the US Navy, US Air Force and National Aeronautics and Space Administration (NASA) to allow maximum adaptability of the engine to other airframe requirements. Reliability and Maintainability and Infrared Countermeasure (IRCM) efforts in other program elements will provide direct technological input to this effort.

WORK PERFORMED BY: General Electric Co., Lynn, MA. Responsibility for the project is vested in the UTTAS Project Manager, US Army Materiel Development and Readiness Command, St. Louis, MO.

PROGRAM ACCOMPLISHMENTS AND FUTURE PLANS:

1. FY 1971, FY 1976 and Prior Accomplishments: Through 1967 the Army developed and bench tested advanced technology components of engines such as compressor and power turbine sections. This advanced component technology was integrated into two separate demonstration engine programs with industry. Fabrication and testing were completed in 1971 and the Army entered Engineering Development for an airworthy, qualified engine specifically for helicopter application. An Engine Request for Quotations was submitted to industry on 30 July 1971. Industry responded in sixty days and the detailed Army evaluation and selection was completed in December 1971 with contract award to General Electric on 6 March 1972. Engine component design layout, detail drawings and drawings for fabrication of hardware were completed in FY 1973. The Critical Design Review was accomplished and the First Engine to Test (FETT) started operation ahead of its milestone schedule. Approximately 420 hours of engine test cell operation had been accomplished. The T700 engine was also selected by the Advanced Attack Helicopter (AAH) competitors in FY 1973. Engine and component development testing continued in FY 1974 with approximately 2200 hours completed. The Ground Test Engines were delivered in March and initial Preliminary Flight Testing Tests (PFRT) started in the 4th Quarter FY 1974. A successful Preliminary Flight Rating Test (PFRT) (60 hour endurance test prior to first flight) was achieved in September. Engine and component development testing was continued and delivery of the flight rated engines was completed in the 4th Quarter FY 1975. A Producibility, Engineering and Planning (PEP) contract was awarded on 26 September 1975 for the determination of Production and Manufacturing requirements. Engine development achieved the 150 hour Military Qualification Test (MQT) rating

Budget Activity #4 - Tactical Programs

Program Element #6.42.06.A Title Utility Tactical Transport Aircraft System (UTAS)

Project #0189 Title Aircraft Engine Development

in March 1976. Some of the tasks that were completed prior to MQT rating were the determination of: Inlet Particle Separator blower bearing life, compressor stall margin, combustor pattern factor, stage 1 turbine nozzle, Hydromechanical Unit acceleration schedule, main fuel pump end plate cracking, and main fuel nozzle erosion. The engine development and maturity testing combined during the FY 1977 period.

2. FY 1977 Program: The engine development testing will be concluded and the engine maturity testing, including completion of the fuel system and miscellaneous component qualification toward achieving the 1200 hour Meantime Between Failure (MTBF) goal will be continued. The GE Y-700 production contract is scheduled to be awarded in December 1976.

3. FY 1978 Planned Program: Conclude engine maturity testing and the R&D Program in June 1978. Decrease in FY 1978 T700 Engine funding results from phase-down of R&D effort concurrent with FY 1977 entry production.

4. FY 1979 Planned Program: No current funding requirements for FY 1979 are reflected in view of R&D program completion in FY 1978.

5. Program to Completion: After completion of the Maturity Phase and DT/OT testing no further RDTE effort is contemplated.

6. Major Milestones:

|   | <u>Date</u> | <u>Estimated RDTE Cost to Reach Events (Cumulative)</u> |
|---|-------------|---|
| a. Engine Development Contract Award              | Mar 72      | 200   |
| b. Delivery of Flight Engines                     | Aug 74      | 42316   |
| c. Engine Military Qualification Test (150 hours) | Mar 76      | 60465   |
| d. Engine Production Contract Award               | Dec 76      | 63120   |

Budget Activity #4 - Tactical Programs

Program Element #6.42.06.A

Project #D189

RESOURCES: (\$ in Thousands)

Title Utility Tactical Transport Aircraft System (UTTAS)

Title Aircraft Engine Development

| <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional<br/>to<br/>Completion</u> | <u>Total<br/>Estimated<br/>Cost</u> |
|----------------|----------------|----------------|----------------|---|-------------------------------------|
| 8149           | 1357           | 3255           | 0              | 0                                       | 0                                   |

RDTE: Funds  
Quantities

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTTAS)

Project #D378

Title Utility Tactical Transport Aircraft System (UTTAS)

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The UTTAS program started with the development objective in 1965. Concept formulation studies were conducted in 1967 to define the required performance parameters for the primary and secondary missions. Its primary mission is the assault delivery of troops and supplies, with aeromedical evacuation as a secondary mission. The UTTAS will be the Army's first true squad carrying helicopter. It is designed specifically to lift an infantry squad in tactical assaults and related combat support missions now performed by the UH-1 series helicopter. The UTTAS replaces the UH-1 in assault helicopter, air cavalry and aeromedical evacuation units. The UTTAS provides a follow-on helicopter with increased payload and substantially improved reliability, maintainability, survivability, crashworthiness and performance. The UTTAS, with a crew of three, will be capable of transporting 11 combat equipped troops, or an equivalent payload, at 4000 feet pressure altitude, 95 degree ambient temperature and exhibit the following characteristics:

Airspeed (knots, true airspeed)  
Endurance (hours)  
Vertical Flight Performance Characteristics (feet per minute) 1/ 450-550  
Armament  
Armor protection  
Avionics

145-175  
2.3  
Two medium machine guns  
7.62mm and redundant critical systems  
Austere (Improved UH-1 avionics)

1/ Using not more than 95% intermediate rated power.

RELATED ACTIVITIES: US Navy and US Air Force requirements have been coordinated with the Army and where appropriate, incorporated into the UTTAS development. The US Navy has initiated action for the Light Airborne Multi-Purpose System (LAMPS) mission and the UTTAS will be considered. A Memorandum of Understanding has been signed by the UTTAS and LAMPS Program Managers.

WORK PERFORMED BY:

CT. Responsibility for the project is vested in the UTTAS Project Manager, US Army Materiel Development and Readiness Command, St. Louis, MO.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976 and Prior Accomplishments: Through FY 1968, the mission requirements and defining the type of aircraft



**Budget Activity #4 - Tactical Programs**

**Program Element #6.42.06.A**

**Title Utility Tactical Transport Aircraft System (UTTAS)**

**Project #D378**

**Title Utility Tactical Transport Aircraft System (UTTAS)**

needed for a combat assault utility helicopter to replace the UH-1 helicopter were studied. During FY 1969 these studies proceeded through the Concept Formulation Phase wherein various capabilities and characteristics for the most effective, least costly (life cycle) UTTAS aircraft were defined. The FY 1970 effort was devoted to cost effectiveness comparisons. The next series of studies in FY 1971 compared the proposed UTTAS with the most competitive US and foreign aircraft: The Westlands/SUD SA-330 PUMA, the Bell Helicopter Company's proposed UH-1H(+), and the Army conceived Advanced UH-1H helicopter equipped with an Advance Technology Engine. As a result of these studies, a Systems Development Plan, a Decision Coordinating Paper, Request for Proposals, and a Determination and Findings were prepared. The development program was approved by Department of Defense on 22 June 1971. Request for Quotation (RFQ) for the UTTAS propulsion system was presented to industry on 30 July 1971. The Source Selection Evaluation of the RFQ resulted in the selection of General Electric as the engine developer with a development contract signed on 6 March 1972. The aircraft Request for Proposal (RFP) was presented to industry on 5 January 1972. The Source Selection Evaluation of the RFPs submitted by Bell Helicopter Company, Boeing Vertol, and Sikorsky Aircraft resulted in the Secretary of the Army awarding contracts to Boeing Vertol and Sikorsky Aircraft on 30 August 1972. Fabrication of flyable prototypes, Ground Test Vehicles and Static Test Articles concluded the major efforts for FY 1973. Both airframe contractors completed fabrication of the Ground Test Vehicles and Static Test Articles in FY 1974. Bench testing of dynamic components, main and tail rotor whirl tests and completion of the airframe Critical Design Reviews were completed on schedule. Engine cell testing accumulated 2200 hours and ground test (XT) engines were delivered on schedule. In FY 1975 both airframe contractors completed fabrication of the flyable prototypes and achieved first flight. The Ground Test Vehicle completed some 400 hours of testing while the Static Test Article underwent design and load static testing. The airframe contractors completed fabrication of the remaining flyable prototypes and started their Basic Engineering Development Flight testing. The GE T-700 UTTAS engine successfully completed the 60 hour Preliminary Flight Rating Test (PFRT) and deliveries of flight rated (YT) engines continued into the 4th quarter. The UTTAS contractors advised the Army that they will exceed the funds specified in their cost-plus-incentive-fee development contracts. The cost growth was attributable to several factors including the adverse effects of inflation, redesigns and work-arounds due to unavailability of materials, and a "price quoted on delivery policy" by the vendors. The Army proceeded according to current contract provisions. After expenditure of FY 1975 funds, which are specified in their contracts, the contractors were allowed to continue at their own risk, on the remaining FY 1975 portion of the program. There was no increase in FY 1975 scope of work. During FY 1976 the Army awarded Producibility, Engineering and Planning (PEP) contracts to both contractors on 4 September 1975. Both airframe contractors continued their development flight testing and achieved the 150 hour Military Qualification Test (MQT) rating. The Army started the Government Competitive Test (GCT) in March 1976 and continued through November 1976. The GE T-700 engine continued its development testing and achieved the 150 hour MQT rating goal in March 1976. The FY 1976 RDTE budget submission included \$14.2 million for work the contractors performed at their own risk and above the FY 1975 contract funding requirements. The Army continued the Government Competitive Test (GCT) and started the source selection proceedings to select a UTTAS winner. The airframe contractors continued the Producibility Engineering and Planning (PEP) phase to prepare for production. The 300 hour Military Qualification Test rating was also completed during this period.



**Budget Activity #4 - Tactical Programs**

Program Element #6.42.06.A

Title Utility Tactical Transport Aircraft System (UTTAS)

Project #D378

Title Utility Tactical Transport Aircraft System (UTTAS)

2. **FY 1977 Program:** The source selection proceedings will be completed in November and a winning design will be selected for a production contract award in December. Maturity phase testing will begin to complete final aircraft surveys and demonstration testing. The GE T-700 production contract is scheduled to be awarded at the same time.
3. **FY 1978 Planned Program:** The maturity phase testing will focus on completion of the Ground Test Vehicle Military Qualification Test; Static Test Article Vulnerability reduction demonstration; Peculiar Support equipment qualifications; main and tail rotor component fatigue testing; full system and miscellaneous component qualification testing; life support environmental and furnishing tests. In addition, operational, Reliability and Maintainability tests at Aviation Engineering Flight Activity and Test and Evaluation Command will be completed. Further, the Producibility Engineering and Planning (PEP) effort will be continued in preparation for the full scale production decision scheduled for the 4th Quarter FY 1979. Decrease in funding from FY 1977 is due to completion of major development effort in prior years and concurrent transition into production.
4. **FY 1979 Planned Program:** Airworthiness and Flight characteristics testing, conduct of cold regions (Arctic Testing), Development Testing III, and Operational Testing III will be completed which will conclude the planned R&D effort. Decrease in required funding from FY 1978 is due to completion of R&D phase and increase in the production effort.
5. **Program to Completion:** After completion of the Maturity Phase and DT/OT III, the RDTE effort will be completed and a full scale production contract for the balance of the 907 aircraft is scheduled to be awarded in October 1979.
6. **Major Milestones:**

|   | <u>Date</u> | <u>Estimated RDTE Cost to Reach Events (Cumulative)</u> |
|---|-------------|---|
| a. Prototype Development Contract Awarded | Aug 72      | \$ 7800   |
| b. First Flight                           | Nov 74      | 163698  |
| c. Prototype Evaluation Completed         | Nov 76      | 304127  |
| d. Production Award                       | Dec 76      | 307961  |
| e. Initial Production Delivery            | Aug 78      | 389329  |
| f. DT/OT III Completed                    | Apr 79      | 395032  |

Budget Activity #4 - Tactical Programs

Program Element #6.42.06.A

Project #D378

RESOURCES: (\$ in Thousands)

Title Utility Tactical Transport Aircraft System (UTTAS)

Title Utility Tactical Transport Aircraft System (UTTAS)

|              | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|--------------|---------|---------|---------|---------|--------------------------------|----------------------------|
| RDTE: Funds  | 85523   | 17301   | 31582   | 2985    | 0                              | 395032                     |
| Quantities   | 6       | 4       | 0       |         | 0                              | 10                         |
| Procurement: |         |         |         |         |                                |                            |
| Funds        |         | 13750   | 236200  | 373500  | 2190035                        | 2937000                    |
| Quantities   |         | 15      | 56      | 129     | 907                            | 1107                       |

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.42.07.A

Title Advanced Attack Helicopter (AAH)

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                |                           |         |         |         |         |                          |                      |
|                | TOTAL FOR PROGRAM ELEMENT | 73930   | 130843  | 200000  | 178543  | 205400                   | 935700               |
|                | Quantities                |         |         |         |         |                          | 9                    |
| D425           | Adv Attack Hel            | 73930   | 130843  | 200000  | 178543  | 205400                   | 935700               |
| Procurement:   | Funds                     |         |         |         |         | 2822400                  | 2822400              |
|                | Quantities                |         |         |         |         | 536                      | 536                  |

BRIEF DESCRIPTION OF ELEMENT: The AAH is a twin engine rotary wing aircraft designed as a stable, manned aerial weapons system. It will be capable of defeating a wide range of targets, including armored vehicles. It will provide responsive direct aerial fires as an integral element of the ground units and be capable of performing its mission at night and under adverse weather conditions. This weapon system will contribute highly mobile and effective firepower to the anti-armor capability of the Army in the field. Aircraft armament includes the HELLFIRE anti-tank missile system, 30MM automatic gun and 2.75" rockets. The AAH will become the primary attack helicopter and will be complemented by the AH-1 Series Attack Helicopters. The current program is a two-phase effort. The first phase was competitive airframe development between two contractors. In Phase 2, the selected airframe contractor will fabricate three additional flying prototypes and develop, integrate, and test subsystems including the competitive development of the Target Acquisition Designation System (TADS) and Pilot Night Vision System (PNVS).

BASIS FOR FY 78 REQUEST: The Planned program for FY 78 is for the continued fabrication of the three Phase 2 prototypes, for continued design, development and testing of mission essential subsystems, and for functional integration of the HELLFIRE missile system and related equipment. All subsystems will be delivered and integrated for first flight of the complete systems vehicle.

Budget Activity #4 - Tactical Programs

Program Element #6.42.07.A

Title Advanced Attack Helicopter (AAH)

BASIS FOR CHANGE IN FY 78 OVER FY 77: FY 77 effort consists of initiation of Phase 2 and the buildup of efforts over nine contract months for the selected airframe prime and seven contract months for the Target Acquisition Designation System (TADS) and the Pilot Night Vision System (PNVS) subcontractors. FY 78 effort will consist of twelve contract months for the prime contractor and the two major subcontractors. A substantially greater integration effort must be performed in addition to the fabrication and delivery of prototype subsystems.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDT&E and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL | Estimated Government Liability Financed with: | FY 1977 & Prior | FY 1978 | TOTAL  |
|----------------------------|------|-------------|-------|---|-----------------|---------|--------|
| (1) Federal Civ. Employees | 206  | 0           | 206   |   |                 |         |        |
| (2) Contractor Employees   | 2350 | 0           | 2350  |   |                 |         |        |
| TOTAL                      | 2556 | 0           | 2556  |   | 351700          | 3500    | 355200 |

TERMINATION COST: (\$ in Thousands)

DETAILED BACKGROUND AND DESCRIPTION: As a result of a special Army Task Force, the Advanced Attack Helicopter (AAH) program was initiated in FY 73 to meet a newly described materiel need, and the AH-56A CHEYENNE development program was terminated in August 1972. The task force identified a need for a smaller, lower speed, less sophisticated, but more agile helicopter than the CHEYENNE. The AAH program was presented to the Defense System Acquisition Review Council (DSARC) I on 28 September 1972. On 10 November 1972, the Army was authorized to release a Request for Proposal (RFP) to industry with industry receiving the RFP on 15 November 1972. The RFP stated a "design to cost" goal for the AAH of \$1.4 to \$1.6 million recurring unit flyaway in constant FY 72 dollars based upon a buy of 472 aircraft produced at an average rate of 8 per month. The RFP also stressed costs, both acquisition and operating, as prime considerations in the program and contractor selection. On 26 February 1976, the Defense Systems Acquisition Review Council directed that the HELFIRE Missile be utilized as the point target weapon for the AAH and on 23 March 1976 this Council directed that the Target Acquisition Designation System (TADS) and Pilot Night Vision System (PNVS) be competitively developed for a flyoff on the AAH. Congressional guidance in the FY 77 authorization and appropriation bills directed that this TADS/PNVS development be managed as part of the AAH program. Funding data include the cost of this additional effort. The winning TADS/PNVS will also be used as mission equipment by the Advanced Scout Helicopter (ASH). The Army's AAH development program consists of two phases. The first phase concluded with a flyoff of prototypes between two contractors to insure airframe acceptability in the critical areas of flight handling qualities and performance. The DSARC II on 7 December 1976 approved full scale development and the Phase 2 contract was awarded to Hughes Helicopters on 10 December 1976. Phase 2 will consist of



**Budget Activity #4 - Tactical Programs**

**Program Element #6.42.07.A**

**Title Advanced Attack Helicopter (AAH)**

integrating subsystems into the aircraft, the fabrication of additional prototypes, and extensive testing. During Phase I each contractor fabricated two flyable prototypes and a Ground Test Vehicle (GTV). During Phase 2 the winning contractor will fabricate three additional flyable prototypes for the subsystems integration and for the follow-on flight test programs involving development and operational testing. Of particular importance to the program is the TADS/PNVS flyoff and selection which will occur during Phase II. The major desired characteristics of the AAH are:

Speed (knots, true airspeed)

Endurance (hours)

Vertical flight and hover performance

145-175

1.83-2.5 (HELLFIRE Configuration)

Hover out of ground effect at 4000 feet/95° Fahrenheit, and climb at 450 to 500 feet per minute using 95 percent Intermediate Rated Power at design gross weight.

8 - 16 HELLFIRE anti-tank missiles, 320-1200 rounds 30mm ammunition

Armament

30MM Weapon Accuracy

Night Capability

Armor Protection

On-Board Navigation Aids

Separate Night Vision Systems for the Pilot and Copilot Gunner

Armored against 12.7MM projectiles for crew and vital components.

Lightweight Doppler Navigation System

During Phase I each contractor was allowed design flexibility through trade-offs of system specifications to achieve a minimum cost solution while achieving a mission satisfactory aircraft.

**RELATED ACTIVITIES:** The Army AH-1S COBRA/TOW, Program Element (P.E.) 6.42.12.A and the Marine AH-1F are related programs. The AH-1S program provides an early aerial anti-tank capability until the availability of the Advanced Attack Helicopter and is planned as a complement to the AAH in a high-low mix. The Marine AH-1F lacks the performance, night vision, and survivability characteristics required in the AAH. The engine installed in the AAH is being developed as a portion of the UTTAS program (P.E. 6.42.06.A). The Hellborne Missile - HELLFIRE (P.E. 6.33.10.A) is being developed as a separate program.

**WORK PERFORMED BY:** Phase I Prime Airframe contractors were Bell Helicopter Co., Ft. Worth, TX, and Hughes Helicopters, Culver City, CA. Hughes Helicopters is the Phase 2 airframe contractor. General Electric Company, Lynn, MA is the manufacturer of the government furnished engine (T700) currently under development. The Advanced Attack Helicopter Project Manager's Office, located at the US Army Aviation Research and Development Command, St. Louis, MO, is responsible for the development program.



Budget Activity #4 - Tactical Programs

Program Element #6.42.07.A

Title Advanced Attack Helicopter (AAH)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Competitive Development Contracts were awarded on 22 June 1973 and during FY 1974 the contractors completed their designs and began fabrication of the three prototype aircraft for Phase 1 testing. Mockup reviews and Critical Design Reviews (CDRs) were completed during the third and fourth quarters of FY 1974. During FY 75, prototype engines were delivered to the airframe contractors to support operation of the Ground Test Vehicle (GTV) and integration into the flying prototypes. Both contractors initiated operation of the Ground Test Vehicle during the latter portion of FY 1975 in preparation for first flight. During FY 1975, both airframe contractors reported cost growth which exceeded the funding levels specified in their contracts. This cost growth was due to the adverse effects of inflation, redesigns and workarounds due to unavailability of materials, and a "price quoted on delivery" policy by vendors. As a result, the Army accelerated a six-month extension in the Phase 1 program, a deferral of work into later fiscal years, and permitted the contractors to continue work on the FY 1975 portion of the program. This was in accordance with the provisions of the contracts. During early FY 1976, both contractors completed their 50-hour GTV run and obtained Safety-of-Flight releases for their vehicles. On 30 September 1975 and 1 October 1975, Hughes Helicopters and Bell Helicopter Textron, respectively, made their first vehicle flights, thereby commencing their flight test programs. In FY 1976, the contractors again experienced cost growth due primarily to correcting technical problems encountered during testing. This resulted in the Army reprogramming \$14.6M to the AAH program in February 1976. On 31 May 1976, each contractor delivered two flyable prototypes to the Government for flight training at the contractors' facilities. During a training flight on 4 June 1976, one of the Bell prototypes experienced an accident caused by a tail rotor shaft failure. The Army permitted Bell to build up their static test article into a flyable prototype for Government Competitive Testing (GCT). GCT scheduled to start on 16 June 1976 was delayed until 6 July 1976 due to the Bell accident and Hughes' delay in presenting data on the fatigue life of critical components. The testing was successfully completed on the last day of FY 77. Source Selection activities began during July 1976 when the Army received the contractors' Phase 2 proposals.

2. FY 1977 Program: The Army completed the source selection evaluation, selected Hughes Helicopters and awarded the Phase 2 Contract on 10 December 1976. The Army received Target Acquisition Designation System (TADS) and Pilot Night Vision System (PNVS) proposals from industry on 27 November and two subcontractors will be selected by the Army to competitively develop TADS and PNVS in March 1977. The airframe prime contractor will modify and update the two Phase 1 aircraft with one continuing required performance and flying qualities test while the other is equipped with mission subsystems, as they become available, for subsequent system testing. Fabrication of three additional prototype aircraft to be equipped with mission subsystems will be initiated and the necessary development and integration of the subsystems will begin and continue throughout FY 1977. The funding shown includes an addition of \$10.7M FY 76 and FY 77 carryover funds from the Advanced Scout Helicopter (ASH) as provided by the FY 77 Appropriations Bill.

3. FY 1978 Planned Program: The Contractor will continue with the flight testing of the one prototype not equipped with subsystems and a Government evaluation will be performed on this vehicle to assess any changes which have to be made to the Phase 1

Budget Activity #4 - Tactical Programs

Program Element #6.42.07.A Title Advanced Attack Helicopter (AAH)

aircraft. Effort on the design, fabrication, assembly and integration of the three additional prototype aircraft and the associated mission subsystems will also continue. All subsystems will be provided to the airframe prime contractor for integration into the Phase 1 vehicle to be equipped with subsystems in preparation for flight. The increase in funding over FY 77 is to cover a full year's effort on those tasks initiated in FY 77.

4. FY 1979 Planned Program: FY 1979 will be highlighted by the first flight of a full systems vehicle and the subsequent completion and first flights of the three newly constructed Phase 2 vehicles. Each vehicle will enter contractor flight testing with particular attention being directed toward the interface of the Target Acquisition Designation System (TADS) and the HELLFIRE missile. There will be a short early Government evaluation of the aircraft performance with each of the competing TADS and Pilot Night Vision System (PNVS) in the first half of the fiscal year. During the last half of the year, the Army and the Contractor will conduct a TADS/PNVS fly-off which will include development and operational testing. The decrease in funding over FY 78 reflects the design and fabrication efforts initiated in FY 77 will be nearing completion.

5. Program to Completion: The Army will select the winning Target Acquisition Designation System (TADS)/Pilot Night Vision System (PNVS) subcontractor, modify the aircraft to bring them to the same subsystem configuration, and complete development and operational testing. The Army users will conduct an independent Operational Test (OT) IIB to assess the overall performance of the system prior to the final Army production decision planned for October 1980.

6. Major Milestones:

|   | Date     | Estimated RDTE Cost to |              |
|---|----------|------------------------|--------------|
|   |          | Reach Events           | (Cumulative) |
| Award Aerial Vehicle (Phase 1) Development Contract | Jun 1973 | \$ 20,000              |              |
| First Flight  | Sep 1975 | 155,000                |              |
| Complete Fly-off                                    | Sep 1976 | 210,900                |              |
| Award Full Scale (Phase 2) Development Contract     | Dec 1976 | 218,100                |              |
| Award Competitive TADS/PNVS Contracts               | Mar 1977 | 285,100                |              |
| Competitive TADS/PNVS Selection                     | Dec 1979 | 796,300                |              |
| Long Lead Time Item Contract                        | Jun 1980 | 848,100                |              |
| Production Contract Award                           | Oct 1980 | 862,100                |              |
| Complete OT IIB                                     | Feb 1981 | 935,700                |              |
| First Production Delivery                           | Jun 1982 | 935,700                |              |
| Initial Operational Capability (IOC)                |          | 935,700                |              |

Budget Activity #4 - Tactical Programs

Program Element #6.42.07.A

Title Advanced Attack Helicopter (AAH)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation (DT&E): Competing AAH contractors, Bell Helicopter Textron and Hughes Helicopters successfully completed Phase I development testing on 30 September 1976. Phase I testing included contractor design support tests, testing of individual components to verify structural integrity and establish fatigue life, and bench testing of dynamic components. Complete dynamic system testing was conducted utilizing the Ground Test Vehicle (GTV) beginning in April 1975. Following successful completion of GTV qualification testing, first flights occurred on 30 September and 1 October 1975 for Hughes and Bell, respectively. Each contractor completed more than 300 hours of flight testing prior to delivery of two flight vehicles each to the Army on 31 May 1976. This contractor flight testing was oriented primarily toward flight envelope development, demonstration of structural integrity, and evaluation and verification of aircraft flight handling qualities. Limited in-flight firing tests of the 30mm cannon and 2.75 inch rockets were also conducted.

Development Test (DT) I was conducted by the Army Engineering Flight Activity (AEFA) at Edwards AFB, CA, during July-September 1976. These tests were conducted primarily to evaluate flight handling qualities and aircraft performance and included in-flight firing of the 30mm cannon and 2.75 inch rockets. Reliability, Availability and Maintainability (RAM) data were obtained throughout the DT test program.

Since Phase I was primarily a competitive airframe development program, testing to date has not included the complete mission equipment package. AAH testing has not included the HELFIRE missile subsystem, Target Acquisition Designation System/Pilot Night Vision System (TADS/PNVS), weapons fire control, nor navigation systems. The development, integration, test and evaluation of these critical subsystems is the primary purpose of the Phase II program.

Phase II development testing will make maximum use of Contractor/Government integrated tests to eliminate duplication.

Initial development testing in Phase II will further expand the aircraft flight envelope and to evaluate any changes/modifications that the winning contractor, Hughes Helicopters, may have proposed to his Phase I design. Concurrently, bench testing of subsystem components will be conducted prior to the first flight of a full subsystem equipped aircraft scheduled for October 1978. Since the TADS/PNVS program is also a competitive development, each of the two TADS/PNVS designs will be installed on two AAH prototypes to be used in a competitive selection scheduled for October 1979.

Following TADS/PNVS selection, all four subsystem aircraft will be equipped with the winning TADS/PNVS for final qualification testing and for use in Operational Test (OT) IIB. Approximately 1570 hours of contractor and 160 hours of Government DT flight testing is scheduled in Phase II.

Production testing is scheduled during FY 1983 and is designed to evaluate production aircraft.

Budget Activity #4 - Tactical Programs

Program Element #6.42.07.A

Title Advanced Attack Helicopter (AAH)

2. Operational Test and Evaluation: Operational Test I (OT I) was conducted during September 1976 at Edwards AFB, CA, by the Operational Test and Evaluation Agency (OTEA) in conjunction with Development Test I (DT I). Approximately 16 hours were flown on each contractor's design during this test utilizing representative attack helicopter mission profiles. Emphasis was placed on evaluating aircraft flight characteristics and mission performance in a low level and nap-of-the-earth (NOE) operational environment. Military crews for the competitive flight tests consisted of Army Engineering Flight Activity (AEFA) test pilots as pilot and experienced attack helicopter pilots from Forces Command units as co-pilot/gunner. Operational Army maintenance personnel observed all maintenance activities. The current Army attack helicopter (AH-1S) was concurrently flown on all AAH missions in order to establish comparative baseline information. OTEA prepared and presented an independent evaluation of OT I to the Army Systems Acquisition Review Council in December 1976. As with DT I, the full weapons, visionics, and navigation subsystems were not evaluated during OT I.

OT II testing will be conducted in two phases. OT IIa - Phase I is scheduled to be conducted by OTEA during Oct-Nov 1979, separate from DT tests at a government test facility. The primary purpose of this test is to permit operational evaluation of the full subsystems equipped aircraft and to provide OT data to assist in the selection of the winning Target Acquisition Designation System/Pilot Night Vision System (TADS/PNVS). This test will include separate firing and non-firing exercises. Four AAH aircraft will be utilized; two equipped with each of the two candidate TADS/PNVS subsystems for a total of approximately 80 flight hours. Flight crews and maintenance personnel will be provided by Forces Command (FORSCOM). OTEA will prepare an independent evaluation of OT II Phase I.

OT IIb - Phase II is scheduled to be conducted by OTEA during Dec 1980-Feb 1981 at a site to be selected. An estimated 240 hours will be flown utilizing three fully equipped AAH's under a complete range of flying conditions and mission profiles. OT II Phase II is designed to confirm the operational suitability of the AAH with emphasis on reliability, availability and maintainability. OTEA will prepare and present an independent evaluation of OT II Phase II.



Budget Activity #4 - Tactical Programs

Program Element #6.42.07.A Title Advanced Attack Helicopter (AAH)

3. Systems Characteristics: Following are the major performance characteristics that are the basis for technical assessments during this first phase of development. Performance requirements are at 4000 feet/95 degrees Fahrenheit.

| Characteristics*   | Contract Value<br>(Floor) | Demonstrated Value** |
|--|---------------------------|----------------------|
| Vertical Rate of Climb (feet per minute)                             | 450 - 500                 | 470                  |
| Cruise Airspeed (knots)  | 145 - 175                 | 142                  |
| Endurance (hours)***   | 1.9 - 2.5                 | 1.83 - 2.5           |
| Ordnance Payload<br>30mm Ammunition (rounds)**<br>Anti-Tank Missiles | 800 - 1000<br>8 - 12      | 320<br>8             |

NOTES:

- \* Performance required at primary mission gross weight, operating within specified mission profiles.
- \*\* From the Source Selection Evaluation Board (SSEB) final report; based on government Development Test (DT) I YAH-64 data and adjusted to the approved armament configuration.
- \*\*\* For the Phase 2 program, endurance - 1.83 hours, ordnance payload 320-500 rounds 30mm ammunition. Adjustment required due to change to HELLFIRE missiles and ADEN/DEFA ammunition.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.42.09.A      Title Aircraft Survivability Equipment  
 Category Engineering Development      Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT<br>Quantities | FY 1976<br>3490 | FY 1977<br>825 | FY 1978<br>5319 | FY 1979<br>4659 | FY 1980<br>5180 | Additional<br>to<br>Completion<br>Continuing | Total<br>Estimated<br>Cost<br>Not Applicable<br>Not Applicable |
|----------------|--|-----------------|----------------|-----------------|-----------------|-----------------|--|--|
| DC52           | Aircraft Survivability<br>Equipment              | 3490            | 825            | 5319            | 4659            | 5180            | Continuing                                   | Not Applicable   |
| Procurement:   | Funds  | 3700            | 4700           | 3200            | 5300            | 8100            |  |  |
|                | Quantities*                                      | 729             | 1041           | 1153            | 603             | 891             |  |  |

\* Procurement total quantities include up to twelve different aircraft survivability equipment (ASE) types. The funds are contained in six different aircraft modification lines.

BRIEF DESCRIPTION OF ELEMENT: The program element is directed toward engineering, testing and type classification for subsequent production of selected aircraft survivability systems to provide protection in a hostile air defense environment. Equipment is also developed to improve crashworthiness of aircraft and provide increased crash survivability of aircrewmembers.

BASIS FOR FY 1978 RDTE REQUEST: Continue efforts in the primary areas of electromagnetic (radar, infrared and optical) signature reduction and suppression. Engineering development will continue on the advanced infrared (IR) signature suppressors for AH-1, OV-1 and Guardrail aircraft. This development is directed at defeating advanced missiles.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Reduced efforts in other engineering development programs resulted in the decrease in FY 1978.

Budget Activity #4 - Tactical Programs

Program Element #6.42.09.A

Title Aircraft Survivability Equipment

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 27   | 0           | 27    |
| (2) Contractor Employees   | 81   | 47          | 128   |
| Total                      | 108  | 47          | 155   |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is engineering development, testing and type classification for subsequent production of selected aircraft survivability equipment systems. These systems are developed for the existing fleet of Army aircraft to provide protection from gun and missile type air defense systems. The Army aircraft survivability program is oriented toward avoiding detection, but if detected to avoid engagement, and if engaged to survive for mission accomplishment. Electromagnetic radiation suppression, ballistic hardening, vulnerability reduction and complementary ground support equipment are developed in this element. The equipment is chosen based on experimental tests and engineering and analytical tradeoff studies. Emphasis is placed on equipment integration for a particular aircraft that insures its survivability throughout its mission envelope. Items pertaining to crash damage and aircrew survivability, such as the crashworthy fuel system for helicopters and the individual survival vest for aircrewmembers, are also addressed in this program.

RELATED ACTIVITIES: Development activities are coordinated with the US Air Force and US Navy on a recurring basis both directly and through the Joint Technical Coordinating Group on Aircraft Survivability (JTCCG/AS). Army effort for JTCCG/AS is conducted under Program Element (P.E.) #6.32.15.A, Joint Survivability Investigations. International coordination is achieved through North Atlantic Treaty Organization (NATO) Standardization Agreements (STANAGS) and Quadripartite Working Groups. Supporting technology under P.E. #6.22.09.A, Aeronautical Technology, and advanced development under P.E. #6.32.08.A, Aircraft Survivability Concepts, are related programs and provide the basis for work conducted in this program. This program interfaces with P.E. #6.47.11.A, D665, Tactical Self-Protection Electronic Warfare Systems, to integrate aircraft survivability systems with complementary active measures.

WORK PERFORMED BY: US Army Aviation Research and Development Command, St. Louis, MO; US Army Air Mobility Research and Development Laboratory, Ft. Eustis, VA; US Army Aviation Test Board, Ft. Rucker, AL; US Army Test and Evaluation Command, Aberdeen Proving Ground, MD; US Army Electronics Research and Development Command, Office of Missile Electronic Warfare, White Sands Missile Range, NM. Contractors: Bell Helicopter Company, Ft. Worth, TX; Lycoming Division, AVCO, Stratford, CT; Pratt and Whitney Aircraft, W. Palm Beach, FL; Hughes Helicopter Company, Culver City, CA; Boeing Vertol, Philadelphia, PA; Aerospace Research Associates, W. Covina, CA; Goodyear Aerospace Corporation, Akron, OH.

**Budget Activity #4 - Tactical Programs**

**Program Element #6.42.09.A**

**Title Aircraft Survivability Equipment**

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. FY 1977, FY 1976, and Prior Accomplishments: Prototype crashworthy fuel system and associated breakaway hoses and valves were developed for the UH-1, AH-1, OH-58, CH-47, CH-54 and OH-6 helicopters. In 1972, a joint Army/Navy program was initiated to develop armored crashworthy pilot/copilot seats for helicopters. Engineering design of the Individual Survival Vest for Aircrew-members was initiated. The crashworthy pilot/copilot seat for the UH-1 was tested and qualified and work continued to develop a common seat for future aircraft. A fuel cell repair kit development was initiated for the crashworthy ballistic tolerant fuel cell. To counter the threat by hostile anti-aircraft weapons, a Required Operational Capability for Aircraft Survivability was approved in FY 1974. Subsequently, a development plan was initiated. Engineering development (ED) for OH-58 and RU-21 infrared (IR) suppressors was initiated in FY 1974 culminating with development test/operational test (DT/OT) II in FY 1976. OV/RV-ID IR hot metal plus plume suppressor efforts entered ED in FY 1975 and continued during FY 1976/FY 1977 with prototype installation completed. Testing of the OV-1 suppressor combined with AN/ALQ-147 IR jammer was initiated in FY 1976/FY 1977 and will continue into FY 1977. AH-1 and OH-58 flat plate canopies were initiated in FY 1975 and are being incorporated into the AH-1S and OH-58C conversion programs. Competitive solicitation for development of AH-1 hot metal plus plume suppressor was let in FY 1976 with contract initiation in early FY 1977. Vulnerability reduction contracts were awarded to develop and qualify transmission and flight control modifications for OH-58 aircraft in FY 1976. Contractor assistance was provided in systems engineering analysis test planning, and specialized measurements to support on-going aircraft survivability equipment (ASE) programs. Basic ASE requirement analysis was initiated for the US Army Security Agency (ASA) fleet of special purpose aircraft.
2. FY 1977 Program: Engineering development (ED) will be initiated on the AH-1 hot metal plus plume suppressor with prototype testing scheduled in November 1977. Government testing of the OV/RV-ID hot metal plus plume suppressor will continue into 2Q FY 1977. Engineering development will be initiated on an improved infrared (IR) suppressor for the UH-1 and for the ASA Guardrail aircraft. The XM-130 Chaff/Flare Dispenser will be adapted to and qualified on the OH-58, UH-1 and RU-21. The OH-58 transmission and flight control vulnerability reduction developments will be completed and tested in FY 1977 and will be applied to the OH-58C. Vulnerability analysis of AH-1 and CH-47 aircraft to include testing AH-1S components will be completed. A contract will be let to provide systems engineering, integration, test and analysis support during the peak loading of the ASE program in FY 1977-FY 1980. IR measurements will be provided for suppressors, jammers and decoys in support of development testing/operational testing (DT/OT).
3. FY 1978 Planned Program: Systems engineering contracts awarded in FY 1977 will continue. The AH-1 hot metal plus plume infrared suppressor effort will continue with initiation of DT/OT II testing. The OV-1 and Guardrail infrared suppressor projects will continue.

Budget Activity #4 - Tactical Programs

Program Element #6.42.09.A

Title Aircraft Survivability Equipment

4. FY 1979 Planned Program: The program provides for overall management of full scale engineering, development of electromagnetic suppression systems, aircraft vulnerability reduction modifications and complementing ground support equipments. New starts in FY 1979 will be source work on a long wavelength infrared jammer and initiating engineering development of aircrewmembers and troop restraint systems for crashworthy aircraft seats, both efforts were deferred from FY 1978. Countermeasures against laser controlled air defense weapons will be initiated also. Virtual completion of the AH-1 suppressor program in FY 1978 permits these new starts with a funding level above FY 1978 and somewhat less than FY 1977.

5. Program to Completion: This is a continuing program.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.42.12.A

Title COBRA/TOW

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT | 3750    | 7482    | 14398   | 10827   | 3600                     | 60987                |
| D639           | COBRA/TOW                 | 3750    | 830     | 14398   | 10827   | 3600                     | 60987                |
| Procurement:   | Funds                     | 56200   | 27200   | 128400  | 127600  | 0                        | 475800               |
|                | Quantities                | 38      | 22      | 83      | 74      | 0                        | 305                  |

BRIEF DESCRIPTION OF ELEMENT: The COBRA/TOW is a single rotor, two place attack helicopter designed to provide the Army with an early helicopter anti-tank capability. Earlier RDTE funds were used to integrate the TOW missile system with the AH-1G (COBRA) helicopter and initiate a program to improve the aircraft agility and maneuverability. Development effort continues to improve the aircraft rocket subsystem, fire control, an automatic gun type weapon, improvement in the main rotor blade and initiation of

BASIS FOR FY 1978 RDTE REQUEST: The requested funds will be directed toward initiation of the development contract for a more operationally effective secondary armament subsystem for the COBRA. This subsystem is required to fulfill tactical needs for aerial fire support, stand-off capabilities and improved survivability. The requested funds also provide the initial effort to develop effective the TOW missile.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Realignment of the Fire Control and Turret Development required increased funding due to revised schedules which accelerated the Turret development effort in FY 1978. A development program for the counter-countermeasure is a new start in FY 1978 and the inclusion of Total Risk Assessing Cost Estimate (TRACE) for all three sub tasks required additional program funds.



Budget Activity #4 - Tactical Programs

Program Element #6.42.12.A Title COBRA/TOW

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |                       |        |        |
|----------------------------|------|-------------|-------|-----------------------|--------|--------|
| (1) Federal Civ. Employees | 23   | 0           | 23    | (1) Estimated Govern- |        |        |
| (2) Contractor Employees   | 175  | 1500        | 1675  | ment Liability        |        |        |
|                            |      |             |       | Financed with:        |        |        |
|                            |      |             |       | RDTE:                 | 55646  | 1800   |
|                            |      |             |       | PROC:                 | 194929 | 0      |
| Total                      | 198  | 1500        | 1698  |                       |        | 57446  |
|                            |      |             |       |                       |        | 194929 |

DETAILED BACKGROUND AND DESCRIPTION: To fulfill an urgent requirement for an operational aerial anti-tank system the Army initiated a development program to provide the AH-1G (COBRA) aircraft with the aerial Tube Launched Optically Tracked Wire Guided (TOW) missile system. The development contract to accomplish this was awarded in March 1972. Eight AH-1G aircraft were modified with the aerial TOW system for the development and testing efforts that began in FY 1973. An AH-1G modified with the TOW missile system is designated AH-1Q. During operational testing of the AH-1Q, it was determined that it had certain performance limitations resulting from the additional weight of the TOW missile system. A Product Improvement Program (PIP), designed to alleviate the performance limitations in the area of hover performance and payload capabilities, was initiated during FY 1974. The program was low risk as the engine was state-of-the-art and is similar to an engine that had already undergone extensive testing. The transmission gear boxes and tail rotor were components already in service on the Marine Corps AH-1J. An AH-1Q modified by the installation of these components has an increase in gross weight from 9,500 pounds to 10,000 pounds and is designated the AH-1S. Funds were approved in FY 1974 and FY 1975 to modify 290 existing AH-1Gs. Additional funds were approved in FY 1975 thru FY 1977 to procure 1-3 AH-1S COBRA/TOWs as part of a 305 total buy procurement program.

RELATED ACTIVITIES: Prior to the revised FY 1973 budget, the Improved Cobra Armament Program (ICAP), which incorporated the TOW missile system on the COBRA, had been previously identified in Program Element 6.42.02.A, Aircraft Weapons. The COBRA's secondary armament subsystem was shifted in FY 1977 from Program Element, Aircraft Weapons, 6.42.02. Also shifted to this element is an advanced technology program to develop a new COBRA main rotor blade. This advanced composite material blade was previously funded under Advanced Structures. This consolidates all on-going developmental COBRA improvement projects under this single element (6.42.12.A) to obtain optimum program management. Office of the Secretary of Defense approved development of both the Army AH-1S and Marine AH-1J because of the different mission requirements.

Budget Activity #4 - Tactical Programs

Program Element #6.42.12.A Title COBRA/TOW

WORK PERFORMED BY: Contractors: Bell Helicopter Textron, Ft Worth, TX - Airframe; AVCO Lycoming, Stratford, CT - Engine; Kaman Aerospace Corp, Bloomfield, CT - Rotor Blade. Weapons subsystems and fire control contractors will be subcontracted by Bell Helicopter Textron by a contractor competitive development effort with approval by the Army of the development contractor. The program is managed by the Project Manager, COBRA, US Army Troop Support and Aviation Readiness Command, St Louis, MO.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 197T, FY 1976, and Prior Accomplishments: Engineering design and integration of the TOW missile subsystem on the AH-1 COBRA helicopter was completed. Development Test (DT) I and Operational Test (OT) of the AH-1Q were completed in FY 1973. Service testing was conducted August thru September 1973 and OT II conducted in October 1973. A follow-on evaluation (FOE) to the AH-1Q OT II was conducted at Ft Hood, TX from April thru June 1974. This FOE was designed to assess the operational effectiveness of the AH-1Q, modified as a result of DT and OT II. These tests identified that the AH-1Q has marginal performance when hovering out-of-ground-effect at combat gross weight. In order to correct this deficiency, the Army initiated a program to improve performance. Contracts were awarded to Bell and Lycoming for development of the uprated components and engine. A Military Potential Test of prototype fire control configurations was conducted in March 1974. Congress appropriated \$4.5M in FY 1975 to support the COBRA/TOW performance (PIP). First flight occurred on 7 Dec 74 and developmental testing was conducted from January thru March 1975. A follow-on evaluation conducted during 7-28 May 75 confirmed the operational effectiveness of the higher gross weight and that engine and power train modifications did not degrade missile hit performance. Development Test III and the Initial Production Test, conducted Aug 1975 to Jan 1976, evaluated the maintenance support package and compliance with contract modification specifications. The overall assessment was that the AH-1Q aircraft met the significant technical requirements of the production contract. The Project Manager's Office initiated a performance validation demonstration of the modified AH-1S in June 1976, which verified the quality and performance of the production aircraft. There have been 133 aircraft delivered to the Army as of 30 Sep 76. Fielding of the accompanying support equipment and trained personnel began in Jan 76. A Phase I engineering contract was awarded on 30 Jun 76 and provides for source selection of the universal turret upgunning and external ammunition stores management/remote set fuzing subsystem. The successful first flight of the Improved Main Rotor Blade was conducted 26 Jul 76.

2. FY 1977 Program: Contractor flight testing of the improved rotor blade and fire control and turret development will continue. A request for procurement was released to Kaman Aerospace Corp. in Oct 76 with subsequent limited rate of initial production contract award for 440 blades planned in Feb 77. The contractor portion of the blade flight test program is targeted for completion in Jan 77. A contract award to Bell Helicopter Textron in Jan 77 is planned for development of turret and stores management/remote set fuzing subsystem.

Budget Activity #4 - Tactical Programs

Program Element #6.42.12.A Title COBRA/TOM

3. FY 1978 Planned Program: Development and qualification, including contractor and government testing, of turret and stores management/remote set fuzing subsystems will continue thru FY 1978. The production subsystem will be delivered beginning in Sep 78. The development of the fire control system will continue and prototype fabrication completed. Initiation of the full scale development for the will begin. Realignment of the Fire Control and Turret Development required increased funding due to revised schedules which accelerated the Turret development effort in FY 1978. A development program for the is a new start in FY 1978 and the inclusion of Total Risk Assessing Cost Estimate (TRACE) for all three sub tasks required additional program funds.

4. FY 1979 Planned Program: Development and testing of the weapons fire control and turret will be completed and development effort on the program will continue. Increase in FY 1979 is due to a 3-year development program initiated in FY 1978 and the inclusion of TRACE.

5. Program to Completion: The development effort will be completed in FY 1980.

6. Major Milestones:

|                                   | Improved Rotor Blade | Weapons Fire Control | Upgunning | Solid State Track Link | Estimated RDTE Cost to Reach Event (Cumulative) (\$ in Thousands) |
|-----------------------------------|----------------------|----------------------|-----------|------------------------|---|
| Development Contract Award        | May 1975             | Jan 1977             | Jun 1976  | Jan 1978               | 11360   |
| Delivery of Prototype Hardware    | Nov 1976             | Feb 1978             | Sep 1977  | Jan 1980               | 22933   |
| Informal In-Process Review        | Dec 1976             | Sep 1978             | Jun 1977  | May 1980               | 25296   |
| Initial Production Contract Award | Feb 1977             | Oct 1978             | Jul 1977  | Jun 1980               | 42443 1/  |
| Development Completed             | May 1977             | Oct 1979             | -         | Sep 1980               | 42443 1/  |

1/ Estimated RDTE cost from FY 1975 thru FY 1980 encompassing the four programs as indicated.

Budget Activity #4 - Tactical Programs

Program Element #6.42.12.A

Title Cobra/TOW

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. Contractor - Bell Helicopter Textron, Fort Worth, TX.

b. The AH-1S aircraft incorporates the Improved Cobra Armament Program (ICAP) and the Improved Cobra Agility and Maneuverability (ICAM) programs.

c. The ICAP program consisted of the following Cobra/TOW tests:

| <u>Test</u>                                     | <u>Schedule</u>    |
|---|--------------------|
| Airworthiness and Flight Characteristics        | Apr thru Jun 73    |
| Engineering Test                                | Jul 73 thru Jan 74 |
| Service Test                                    | Aug thru Sep 73    |
| Winter Test                                     | Jan - Feb 75       |
| Development Test III/Initial Production Testing | Aug 75 thru Jan 76 |

d. The ICAM program consisted of the following development tests:

| <u>Test</u>   | <u>Schedule</u>    |
|---|--------------------|
| Flight Load Survey  | Jan - Feb 75       |
| Airworthiness and Flight Characteristics                      | Apr - May 75       |
| Army Preliminary Evaluation                                   | Apr thru May 75    |
| Structural Demonstration                                      | Mar 75             |
| Reliability, Availability, Maintainability (RAM) 600 hr. Test | Sep 75 thru May 76 |
| Production Verification Demonstration                         | Jun - Jul 76       |

e. No major additional development testing is planned as the AH-1S Cobra/TOW was type classified Standard on 1 Oct 1976.

f. The Improved Main Rotor Blade Task 03 will be installed on previously qualified AH-1 aircraft.

g. There were no ICAM component failures during the 600 hour accelerated test. This indicates the new dynamic components have better RAM characteristics than those of the AH-1C/AH-1Q.

Budget Activity #4 - Tactical Programs

Program Element #6.42.12.A

Title Cobra/TOW

2. Operational Test and Evaluation:

a. Operational Test (OT I) on the AH-1Q was conducted in conjunction with OT I at Yuma Proving Ground, Arizona, from April thru June 73 by the US Army Armor Center. OT I was a limited operational test in that a tactical scenario was not used. Thirty hours of flight time and four TOW missiles were provided only for crew training courses. OT I test objectives were to provide early examination and evaluation of (1) target acquisition and engagement functions; (2) training requirements; and (3) operational capabilities and maintainability features. OT I test results indicated that the AH-1Q is capable of accurate TOW missile delivery against point targets but is power limited due to weight, particularly when hovering out-of-ground effect (HOGF). OT I tests also confirmed that vibrations are introduced in the TOW sight when nose turret weapons subsystems are fired. Both of these deficiencies were addressed in OT II.

b. OT II on the AH-1Q was conducted by the Armor Center at Fort Knox, KY, from 1-31 Oct 1973. The test was conducted under tactical conditions and included 109 flight hours on a prototype AH-1Q and 52 TOW missile firings by pilots from the 7 Sqn, 1st Cavalry. The test report was prepared by the Armor Center and the Independent Evaluation was prepared by the Army's Operational Test and Evaluation Agency (OTEA). The OT II Independent Evaluation concluded that the AH-1Q was an effective anti-armor system but the following deficiencies impact on mission accomplishment:

- (1) Marginal power exists to hover-out-of-ground effect at combat gross weight. This deficiency was subsequently corrected by product improvements to the engine and transmission.
- (2) AH-1Q TOW hit performance is degraded beyond 1,700 meters.
- (3) Canopy light reflection or glint frequently disclosed firing positions. Subsequently corrected by redesign of the canopy.
- (4) Lack of effective rain removal systems on the AH-1Q canopy and telescopic sight unit degrades the ability of AH-1Q to acquire targets, to employ nap-of-the-earth flight and to effect hovering fire during periods of light precipitation.



Budget Activity #4 - Tactical Programs

Program Element #6.42.12.A

Title Cobra/TOW

c. As a result of Operational Test (OT) II and Development Test (DT) II, the following significant system modifications were made to improve hit performance:

- (1) Reduction of thickness of the telescopic sight reticle.
- (2) Reduction of telescopic sight blur or bounce during firing of turret weapons.
- (3) Correction of helmet sight magnetic disconnect problems.
- (4) Improvement of boresight retention.

d. A follow-on evaluation (FOE) to the AH-1Q OT II was conducted by Modern Army Selected Systems Test Evaluation and Review (MASTER) at Ft. Hood, TX, 15 Apr - 30 Jun 74 by the 7th Sqdn, 17 Cavalry. The FOE was designed to assess the operational effectiveness of the AH-1Q, modified as a result of OT II and DT II. The scope of the FOE included 385 flight hours and 103 recorded missile firings, and evaluation of the TOW Airborne System Test Set and AH-1Q Reliability, Availability and Maintainability (RAM) characteristics. The Operational Test and Evaluation (OTEA) Independent Evaluation indicated that:

- (1) The AH-1Q's effectiveness as a day anti-armor system has been increased by the system modifications made since OT II.
- (2) The AH-1Q will impose a significantly greater support burden than the AH-1G but support should be adequately available if:
  - (a) AH-1Q peculiar support requirements are recognized and provided.
  - (b) Boresighting problems are corrected and/or accommodated by provision of boresighting resources.
  - (3) The gunner training program is adequate.
- (4) The prototypes tested in the FOE did not have certain improvements which had been completed or were under development, including those which would provide:
  - (a) Increased power.
  - (b) Reduced canopy light reflection. This deficiency has been corrected by redesign of the canopy utilizing the flat plate concept.
  - (c) Rain removal from the canopy and telescopic sight.

Budget Activity #4 - Tactical Programs

Program Element #6.42.12.A

Title Cobra/TOW

e. A follow-on evaluation (FOE) of the AH-1Q Improved Cobra Agility and Maneuverability (ICAM) (AH-1S) was conducted at Ft. Hood, TX, 7 May 75 - 28 May 75 by the 7th Sqdn, 17th Cavalry. The FOE was to assess operational effectiveness of modifications which provided increased power. The scope of FOE include 30.5 flight hours 24 recorded missile firings. The Operational Test and Evaluation (OTEA) Independent Evaluation indicated that:

(1) AH-1S was always able to carry full fuel, and calculations indicated it was always capable of hovering out-of-ground effect (HOGE) at a 10,000 pound gross weight under test conditions.

(2) Engine and power train modifications did not affect hit performance.

(3) missile hits out of 24 missile launches resulted in a Hit Probability (PH) of 100%

f. OTEA monitored the Improved Cobra Armament Program (ICAP) Development Test (DT) III, which was conducted by Test and Evaluation Command (TECOM) at Yuma Proving Ground, AZ, from 6 Aug 75 to 12 Jan 76.

g. A combined OT II/DT II of the Improved Main Rotor Blade for the AH-1S Cobra will be conducted at Ft. Hood, TX. Tentatively the test will be conducted Feb-Apr 77 utilizing troops from a FORSCOM attack helicopter company.

3. Systems Characteristics:

a. ICAP/ICAM Characteristics

Max gross weight (lbs)  
Endurance (hrs)  
Combat Radius (NM)  
Speed Cruise (kts)  
Hit Probability

Objectives

10,000  
2.5  
131  
128

Demonstrated

10,000\*  
2.9\*\*  
134\*\*  
129\*\*

\* Determined during FOE May 75

\*\* Determined during DT testing

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.42.13.A

Title CH-47 Modernization

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 9800    | 2250    | 25875   | 32022   | 16336   | 10778                    | 97061                |
| DC37           | CH-47 Modernization                  | 9800    | 2250    | 25875   | 32022   | 16336   | 10778                    | 97061                |
| Procurement:   |                                      |         |         |         |         |         |                          |                      |
|                | Funds                                |         |         |         |         |         |                          |                      |
|                | Quantities                           |         |         |         |         |         |                          |                      |
|                |                                      |         |         |         |         | 1464209 | 1464209                  | 1464209              |
|                |                                      |         |         |         |         | 361     | 361                      | 361                  |

BRIEF DESCRIPTION OF ELEMENT: Provides for incorporation of advances in design technology developed since introduction of CH-47s into Army inventory. Effort will be expended to modify current CH-47 fleet through development and testing of seven modernized systems; rotor, drive, hydraulic, electrical, advanced flight control, cargo handling, and auxiliary power unit. Integration of these changes will result in improved reliability, availability, maintainability, safety, survivability, and reduced vulnerability.

BASIS FOR FY 1978 RDTE REQUEST: Airframe modification for installation of modernized components will continue, rotor blade testing will be conducted and first ship set of blades will be delivered. Installation drawings and procurement of the hydraulic system will be completed, drive system parts will be available for test, and fabrication and assembly of flight control system will be finalized.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Increased level of effort preparatory to prototype flight test. Completion of 110 hours, whirl tower test and rotor blades, drive and hydraulic systems assembled and preliminary testing completed and High Time Depot Maintenance on the CH-47 B and C models will be completed, modification continues.

Budget Activity #4 - Tactical Programs

Program Element #6.42.13.A Title CH-47 Modernization

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 35   | 0           | 35    |
| (2) Contractor Employees   | 445  | 0           | 445   |
| TOTAL                      | 480  | 0           | 480   |

TERMINATION COST: (\$ in Thousands)

|   | FY 1977<br>and<br>Prior | FY 1978 | Total |
|---|-------------------------|---------|-------|
| (1) Estimated Government Liability Financed with: | 44204                   | 10000   | 54204 |

\* Plus subvendor impact.

DETAILED BACKGROUND AND DESCRIPTION: The CH-47 (Chinook) medium lift helicopter (MLH) was developed in the late 1950's with the first CH-47s being procured in 1962. The Chinook provided invaluable battlefield mobility in Vietnam for tactical vehicles, artillery and engineer equipment, personnel, and logistical support equipment. The Chinook will continue to meet the Army medium lift requirement during the 1980's. The current Army inventory consists of 168 CH-47 As, 79 CH-47 Bs, and 197 CH-47 Cs. The CH-47 A and B models constitute 56 percent of the fleet and fail to meet the Required Operational Capability (ROC) of 15,000 lb. payload for medium lift helicopters. All models have high operating costs, large maintenance requirements and require modernization. The objective of this program is to develop fiberglass rotor blades, a 7500 horsepower integrally lubricated transmission and drive system, modularized hydraulics system components, and accomplish the necessary engineering and design required to install a new electrical system, an improved auxiliary power unit, multiple cargo hooks and an advanced flight control system in a prototype of each of the three models. The program goals are to improve reliability, availability, maintainability, survivability, and safety while reducing operating costs and standardizing the MLH fleet lift capability at 15,000 lbs.

RELATED ACTIVITIES: The Automatic Tape Lay-up Program, Program Element 6.42.04.A (Project DC31, Aircraft Subsystems and Components), was redirected in FY 1974 to support development of the advanced technology, composite-fiberglass rotor blades for use on the CH-47. It was incorporated into the modernization program in FY 1976.

WORK PERFORMED BY: On 4 June 1976, a contract for engineering development of the airframe was awarded to the Boeing Vertol Company, Philadelphia, PA, and on 28 July 1976, a contract for engine support was awarded to AVCO Lycoming, Stratford, CT.

Budget Activity #4 - Tactical Programs

Program Element #6.42.13.A Title CH-47 Modernization

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 197T, FY 1976, and Prior Accomplishments: FY 197T, FY 1976 and Prior Accomplishments. Life cycle cost estimates and economic analysis for the CH-47 fleet was completed and indicated that it was more cost effective to modernize CH-47s than to retire these aircraft and procure new helicopters. A required Operational Capability (ROC) was approved in October 1974 and a Special Study Group (SSG) was formed in December 1974 to prepare the program for Army System Acquisition Review Council (ASARC) II and Defense System Acquisition Review Council (DSARC) II. Based on the SSG, it was determined that modernization could best be accomplished by the incorporation of seven modernized systems; rotor system, drive system, hydraulic system, auxiliary power unit, electrical system, advanced flight control system and the cargo handling system. A Cost and Operational Effectiveness Analysis (COEA) determined that the most cost effective approach would be to modernize a total of 361 CH-47 As, Bs and Cs. In April 1975, an advanced development contract was awarded to Boeing Vertol to proceed with necessary analysis and advanced engineering to design transmission and hydraulic systems. A separate engineering development contract was continued under Project DC31 for development of fiberglass rotor blades. ASARC II and DSARC II was conducted on 4 August and 16 October 1975, respectively. The Councils approved transition into Engineering Development and pursuit of a three prototype R&D program leading to modernization of the CH-47. The Decision Coordinating Paper (DCP) was approved 4 December 1975. A contract for research and development effort by Boeing Vertol was negotiated in March 1976 and awarded 4 June 1976. The contract is a sole source cost-plus-incentive fee (CPIF) with a target cost of \$66 million on a 70/30 share ratio, minimum fee of \$1.32 million (2 percent), target fee of \$5.28 million (8 percent), maximum fee of \$9.9 million (15 percent), and a separate award fee of \$3.6 million for design-to-cost and RAM efforts. On 28 July 1976, a contract for support of the program was awarded to the engine contractor AVCO Lycoming. Contract is a sole source cost-plus-incentive fee with a target cost of \$3.669 million on an underrun share ratio of 50/50 and an overrun share ratio of 75/25, minimum fee of \$73 thousand (2 percent), target fee of \$319 thousand (8.7 percent), and maximum fee of \$550 thousand (15 percent). An interface agreement between the engine and the airframe contractor was finalized on 12 August 1976 providing for exchange of data regarding configuration control, interface change requirements, engine, hardware and test program requirements. In the airframe program detail and tool design, preparation of the assembly and installation drawings continued. Long lead time items have been ordered. In the engine program, procurement of nine (9) modification kits for GFE L-11D engine and hardware for nine (9) fuel controls was initiated.
2. FY 1977 Program: Detail design, tool design, preparation of assembly and installation drawings, manufacturing and/or procurement of required hardware continues. Transmission testing will begin. High Time Depot Maintenance (HTDM) on the A model will commence. During this period, a contract milestone, completion of the aft tool proving blade will be met. Four of the nine Government Furnished Equipment (GFE) engines, together with nine GFE fuel controls will be inducted into the engine conversion program. A fuel control study and GFE starter evaluation will be conducted.



Budget Activity #4 - Tactical Programs

Program Element #6.42.13.A Title CH-47 Modernization

3. FY 1978 Planned Program: 110 hours of whirl test of the fiberglass rotor blade will be conducted. Subcomponents of the drive and hydraulic systems will be received, assembled, and preliminary testing accomplished. High Time Depot Maintenance (HTDM) on the B and C models will be completed and modification will continue. The proving tool for the forward rotor blade will be completed and first ship set of rotor blades (8) will be available. Out of the total nine engines inducted four will be completed and shipped to the airframe contractor; the remaining five engines will be inducted for conversion. The increased funding over FY 1977 is due to an increased level of effort in preparation for installation and final assembly of the prototypes for first flight.

4. FY 1979 Planned Program: Remaining five engines will be delivered for interface on B and C model airframes. Fiberglass rotor blade development will be completed, 2d and 3d ship sets will be available and fatigue tests will be run. Dynamic strain survey of all five transmissions will be accomplished, 50-hour run on the forward and aft transmission and 200-hour run on the combining transmission will be completed. Modernized A model will undergo first flight. A reduced level of effort from FY 1978 is due to final tests being conducted and completion of final assembly in preparation for first flight.

5. Program to Completion: B and C models will complete first flights, followed by Development Test II/Operational Test II (DT/OT II) testing to assure validity of design, ascertain accomplishment of Reliability, Availability and Maintainability (RAM) objectives and substantiate flight safety improvements. Completion of this program will provide the basis for definitive improvements to be included in a modernization program for the total CH-47 fleet.

6. Major Milestones:

|  | Date   | Estimated RTE Cost |                     |
|--|--------|--------------------|---------------------|
|  |        | To Reach           | Events (Cumulative) |
| a. Army Systems Acquisition Review Council (ASARC) II    | Aug 75 | 5516               |                     |
| b. Defense Systems Acquisition Review Council (DSARC) II | Oct 75 | 6279               |                     |
| c. Modernization Research and Development Contract Award | Jun 76 | 16079              |                     |
| d. 110 Hours Blade Whirl                                 | Dec 77 | 52601              |                     |
| e. Transmission Dynamic Strain                           | Mar 79 | 85960              |                     |
| f. 50-Hour Transmission Survey Run                       | Apr 79 | 87321              |                     |
| g. 1st Flight  | Sep 79 | 94128              |                     |
| h. Army Preliminary Evaluation                           | Dec 79 | 96682              |                     |
| i. DT II/OT II Start                                     | Jan 80 | 97533              |                     |
| j. DT/OT II Complete                                     | Jun 80 | 101790             |                     |
| k. ASARC III   | Aug 80 | 103493             |                     |

Budget Activity #4 - Tactical Programs

Program Element #6.42.13.A

Title CH-47 Modernization

|   | Date   | Estimated RDTE Cost<br>To Reach Events (Cumulative) |
|---|--------|---|
| l. DSARC III                            | Sep 80 | 104345  |
| m. Initial Production Contract Award    | Sep 80 | 104345  |
| n. DT III/OT III Start                  | Oct 81 | 104906  |
| o. Initial Production Delivery          | May 82 |   |
| p. Full-Scale Production Contract Award | Sep 82 |   |
| q. DT III/OT III Complete               | Mar 83 |   |
| r. Initial Operation Capability (IOC)   | Aug 83 |   |
| s. First Full-Scale Production Delivery | Sep 83 |   |

Budget Activity #4 - Tactical Programs

Program Element #6.42.13.A Title CH-47 Modernization

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: Development test and evaluation will be conducted by the contractor, Boeing Vertol, and the Army, with contractor testing on all three models and government testing on the B and C models. Development Testing (DT II) begins with the Contractor Engineer Design Testing (EDT-C) which will include ground and bench testing of new components and Prototype Qualification Testing (PQT-C) on three prototype aircraft. Fiberglass blade testing begins in 1977 culminating with the 110 hour whirl tower test. Transmission and hydraulic bench tests will begin in 1978 with the transmission dynamic strain survey and the 50 hour qualification test scheduled for early 1979. A total of 950 hours of bench testing on all five transmissions will be accumulated with first flight scheduled for mid-1979. The Contractor flight test program is approximately 167 hours. Government testing will consist of the Army Preliminary Evaluation (APE), Icing, Military Functional, Operational Test, Climatic Hangar, and RAM Verification. Government testing begins with 25 flight hours during APE to verify flight safety and performance requirements in the fall of 1979. The Icing test, consisting of five flight hours, provides data verifying the aircraft flight envelope in icing conditions during the winter of 1979. The Military Functional testing, including aircraft performance, Reliability, Availability and Maintainability (RAM), and operability requirements will be evaluated utilizing two aircraft for a total of 280 flight hours early in 1980. The climatic hangar tests in mid-1980 includes 30 hours of extreme environmental testing to demonstrate the modernized CH-47s capability to meet stated specifications. Supplemental Government testing entitled RAM Verification will be an extension of the Military Functional test. The YCH-47D data base including RAM, performance in extreme environments, logistic support, etc., will be expanded. Approximately 700 flight hours will be accumulated from mid-1980 through early 1981. DT III will be accomplished on Low Rate Initial Production (LRIP) aircraft. A total of 175 flight test hours are planned for DT III over a period of 15 months commencing in October 1981.

2. Operational Test and Evaluation: Operational test and evaluation (OT II) will be conducted by the Operational Test and Evaluation Agency (OTEA) using the same two prototypes used in Development Tests II. A total of 120 flight hours of OT II testing will be conducted during the spring of 1980. A Coordinated Test Program covering DT/OT II phase has been developed which defines milestone objectives, schedules and criteria for this phase of testing. OT III tests will consist of approximately 800 hours on early production models commencing in the spring of 1982. Prior to approval of the Low Rate Initial Production for 16 aircraft, approximately 617 hours of testing will be completed. Prior to Full-Scale Production approximately 1592 hours of testing will be completed.

Budget Activity #4 - Tactical Programs

Program Element #6.42.13.A Title CH-47 Modernization

3. System Characteristics:

Operational/Technical Characteristics

Max Gross Weight (lbs)  
 Max Cruise Speed (Kts.) (Design Gross Weight)  
 Combat Radius (NM) (ROC Mission)  
 Service Ceiling (ft.) (Design Gross Weight, One Engine Inoperative)  
 Ferry Range (NM)  
 Payload (ROC Mission) (lbs.)  
 Hardware Systems Reliability (MTBF) (hours)  
 Systems Operational Reliability (MTBF) (hours)

Objectives

50,000  
 155  
 30  
 10,000  
 1,000  
 15,000  
 1.52\*  
 .76\*

Demonstrated

To be determined  
 through testing  
 of prototype  
 aircraft.

1/ Required Operational Capability (ROC)

\*Reliability values to be demonstrated prior to Low Rate Initial Production (LRIP).

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.42.14.A

Title Interim Scout Helicopter

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES/PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT      | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---|---------|---------|---------|---------|--------------------------|----------------------|
|                | Quantities                              | 0       | 0       | 18300   | 14800   | 6700                     | 39800                |
| B426           | Helicopter Target Acquisition Subsystem | 0       | 0       | 18300   | 14800   | 6700                     | 39800                |

BRIEF DESCRIPTION OF ELEMENT: This program element supports engineering design, integration and testing efforts to install a target acquisition and laser designator device on an existing helicopter in order to provide an interim scout capability.

BASIS FOR FY 1978 RDTE REQUEST: Initiate the design effort necessary to integrate and install a target acquisition and laser designation subsystem on an existing helicopter.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Not applicable.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                                | RDTE | PROCUREMENT | TOTAL |
|--------------------------------|------|-------------|-------|
| (1) Federal Civilian Employees | 44   | 0           | 44    |
| (2) Contractor Employees       | 85   | 0           | 85    |
| TOTAL                          | 129  | 0           | 129   |

DETAILED BACKGROUND AND DESCRIPTION: A void currently exists in the ability of air cavalry reconnaissance and surveillance combat elements to extend their coverage while maintaining stand-off distances from sophisticated hostile air defense weaponry. A deficiency will exist in the near future in the ability of aerial scouts to laser designate for precision guided munitions and to handoff targets to attack helicopters. The light observation helicopters in the inventory are currently being used in air cavalry, attack helicopter and field artillery units to perform the reconnaissance, surveillance and target acquisition function.



Budget Activity #4 - Tactical Programs

Program Element #6.42.14.A

Title Interim Scout Helicopter

However, they are only equipped with hand held optics and have neither an electro-optical target acquisition device for standoff nor a laser designator for target handoff or precision guidance of terminal homing munitions. The advanced scout helicopter is projected to eventually fill the void that exists. However, this system will not be available until the late 1980's. To provide an initial aerial scout capability, an existing helicopter will be equipped with a target acquisition and designation device. The engineering design, integration and testing to equip an existing airframe with this device will be done under this program. These interim helicopter systems will be temporarily utilized in the scout role until an advanced aerial scout can be developed and fielded to fully satisfy the Army's need.

RELATED ACTIVITIES: Advanced development research has been done under Program Elements #6.37.19.A, Surveillance Target Acquisition and Night Observation, and #6.33.06.A, Terminal Homing Systems.

WORK PERFORMED BY: The contractors for a target acquisition subsystem and the aircraft modification design and integration efforts for the airframe have not been determined. In-House developing organization: US Army Aviation Research and Development Command, St. Louis, MO.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: None - This is a new effort in FY 1978.
2. FY 1977 Program: None - This is a new effort on FY 1978.
3. FY 1978 Planned Program: The principal objectives will be to conduct analyses, design and preliminary integration efforts. The necessary experimental work has been performed and the proposed design and integration effort is ready for full scale development. Prototype fabrication of the aircraft modification kit will commence prior to receipt of the target acquisition subsystem in the following year.
4. FY 1979 Planned Program: Design, integration and fabrication efforts of the aircraft modification kit continue. Upon delivery of the target acquisition subsystem, installation and integration will be accomplished on the airframe. Contractor flight testing of the total system will commence.
5. Program to Completion: Contractor flight testing will be completed, government flight testing will be accomplished and the modification kit design to accommodate the target acquisition subsystem will be finalized.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.43.06.A

Title STINGER

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project<br>Number | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|-------------------|---------------------------|---------|---------|---------|---------|--------------------------------|----------------------------|
|                   | TOTAL FOR PROGRAM ELEMENT | 22,659  | 25,425  | 17,509  | 24,688  | 14,462                         | 197,660                    |
| D646              | STINGER<br>Quantity       | 22,659  | 25,425  | 17,509  | 24,688  | 14,462                         | 197,660<br>179             |
| Procurement:      |                           |         |         |         |         |                                |                            |
| Funds             |                           |         |         | 84,700  | 130,300 | 441,600                        | 656,600                    |
| Quantities        |                           |         |         | 890     | 4,650   |                                |                            |

BRIEF DESCRIPTION OF ELEMENT: This program element provides for full scale development of a Manportable Air Defense Weapons System. Engineering Development (ED) will essentially be completed with FY 77 funds. A third generation Infrared Seeker is programmed to enter full scale development in FY 77.

BASIS FOR FY 1978 RDTE REQUEST: Essential research and development functions for STINGER system will be completed. Support and management of remaining development tests of the basic system will be completed. Continuation of programmed full scale development of a new advanced seeker (POST) is planned. Design of the seeker and guidance changes, test and test support targets are major costs to be supported. Development of this new seeker will provide a marked improvement in infrared countermeasures environment and acquisition range.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Decrease is due to completion of research and development for the basic STINGER system in FY 77. Funding request for FY 73 is to support continued development of an advanced seeker to provide an increased capability. It is planned that this seeker will be phased into production upon completion of development.

Budget Activity #4 - Tactical Programs

Program Element #6.43.06.A

Title STINGER

PERSONNEL IMPACT:

TERMINATION COST: (\$ in Thousands)

|                           | RDTE | PROCUREMENT | TOTAL | FY 1977<br>& Prior | FY 1978 | TOTAL   |
|---------------------------|------|-------------|-------|--------------------|---------|---------|
| (1) Federal Civ Employees | 46   | 0           | 46    | 114,900            | 1,000   | 115,900 |
| (2) Contractor Employees  | 100  | 940         | 1,040 |                    |         |         |
| TOTAL                     | 146  | 940         | 1,086 |                    |         |         |

DETAILED BACKGROUND AND DESCRIPTION: The currently fielded REDEYE Guided Missile System exhibits serious limitations in view of the current and postulated threat posed by enemy support and interdiction jet aircraft. REDEYE can attack only receding aircraft flying at speeds less than and is vulnerable to a variety of The purpose of this program is to develop, test and field STINGER as the successor to REDEYE. As a successor to REDEYE, STINGER is expected to overcome the above cited deficiencies by being capable of engaging threat aircraft from any aspect flying at speeds up to 1000 mph. STINGER will complement PATRIOT (SAM-D) in the air defense of the field Army. STINGER will be deployed with both Army and Marine Corps forward combat elements and is expected to replace REDEYE generally on one-for-one basis. STINGER is similar to REDEYE in that it is a shoulder fired, passive infrared homing guided missile system. STINGER will have a higher performance rocket motor, an advanced seeker, a separable reusable gripstock, a new launcher and a lightweight Identification, Friend or Foe (IFF) device. The total weight of the missile and its launcher, in the ready-to-fire configuration will be 33.4 pounds. The fire unit will be a two-man team, authorized a basic load of six missiles. Advanced Development of an Advanced Seeker (POST) has demonstrated feasibility of a two color (infrared and ultraviolet) design which will be virtually immune to countermeasures. Initiation of full scale development in FY 77 is planned.

RELATED ACTIVITIES: This program is a joint development with the United States Marine Corps. Production requirements for that service are fully coordinated with the Army.

WORK PERFORMED BY: Development of the STINGER basic system and the POST seeker is under the direction of the US Army Missile Research and Development Command, Huntsville, AL. The prime contractor is the Pomona Division of General Dynamics, Pomona, CA. Atlantic Research division of the Susquehanna Corporation, Greenville, VA, is the developer of the rocket motor. Other Government agencies which will contribute during the development phase are the US Army Armament Research and Development Command, Dover, NJ (missile warhead), and the US Army Electronics Research and Development Command, Fort Monmouth, NJ (electronics and battery).

Budget Activity #4 - Tactical Programs

Program Element #6.43.06.A

Title STINGER

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. FY 1977, FY 1976 and Prior Accomplishments: In 1965, a series of advanced development efforts was begun to demonstrate the critical components require for an improved, shoulder-fired air defense missile which would engage low flying aircraft from any engagement aspect flying at speeds up to 'The effort demonstrated through firings at jet aircraft targets that such components were feasible. In June 1972, STINGER entered formal Engineering Development. The baseline design was completed in 1974. A logical progression of component/assembly tests was accomplished. Propulsion qualification was completed. Guided Test Vehicle (GTV) firings were initiated. Technical problems demonstrated in early GTV tests were solved and tested with hardware demonstrations. A design-to-cost effort titled STINGTHRIFT was completed resulting in an estimated \$29 million savings in procurement. In FY 75, the GTV series of tests were completed with positive indications of system performance criteria being met. A total of 16 GTV firings conducted demonstrated 75 percent success rate against threat representative targets. A design flight test program (18 rounds) was initiated to confirm design parameters. Producibility Engineering Planning (PEP) was initiated which will cause delivery of Special Acceptance Inspection Equipment and drawings for the Initial Production Facilities (IPF). In FY 76 and FY 77, the Prototype Qualification Tests-Contractor (PQT-C) was continued. These flights were to determine if the contractor has met his contract specifications. The government initiated Prototype Qualification Test-Government (PQT-G) to independently evaluate system performance against requirements. There are 84 flights planned in Prototype Qualification Test-Contractor (PQT-C) under varying environmental conditions. The Operational Test and Evaluation Agency (OTEA) also began to test the system (Operational Test II).
2. FY 1977 Program: The PQT-G program will be completed. Development Test/Operational Test II (DT/OT II) Temperate, Arctic and Tropic tests will be completed. Test and range support, targets and test command involvement are test elements. Production Engineering Planning (PEP) will be completed to result in Special Acceptance Inspection Equipment delivery and drawings for Initial Production Facilities. The start of Engineering Development of an Advanced Seeker (POST) is programmed for this fiscal year. A decision on this effort is expected April 1977. The POST seeker will greatly enhance performance in an Infrared Countermeasures environment as well as acquisition of targets in severe infrared environments, and acquisition range.
3. FY 1978 Planned Program: Management of remaining research and development functions for the STINGER system will be completed. Major R&D efforts will be directed toward development of the new advanced seeker. Hardware fabrication of prototype samples for evaluation in both laboratory and flight environments is planned. Range and Target support to the contractor efforts are included. Simulation and system engineering efforts are major elements planned. Total funds programmed is less than FY 77 due to completion of development of the basic STINGER system.
4. FY 1979 Planned Program: Development of the advanced seeker will be continued. Production Engineering Planning (PEP) program is underway as well as intensive testing to validate the design in both environmental and vibration extremes. Total funds required in FY 79 exceeds that in FY 78 because PEP efforts are to be initiated this fiscal year.

Budget Activity #4 - Tactical Programs

Program Element #6.43.06.A

Title STINGER

5. Program to Completion: Completion of Engineering Development of the Advanced Seeker will be pursued to completion. Tests, test support and Producibility Engineering Planning will be completed.

6. Major Milestones:

|  | Date    | Estimated RDTE Cost to Reach Events (Cumulative) |
|--|---------|--|
| a. Baseline Design Established   | Mar. 73 | 14.0   |
| b. Completion of Component Tests   | Nov 73  | 34.0   |
| c. Completion of GTV Program   | May 75  | 87.3   |
| d. Completion of Design Flight Tests   | Jan 76  | 94.6   |
| e. Completion of PQT-C   | Oct 76  | 115.3  |
| f. Completion of Sufficient Developmental Tests/Operational Test II (DT/OT II) | Feb 77  | 123.4  |
| g. Completion of R&D Program (STINGER System)                                  | Sep 77  | 136.626  |
| h. Initiation of Engineering Development (ED) of Advanced Seeker (POST) \$3.1M | May 77  | 139.726  |
| i. Completion of ED of POST  | Sep 80  | 194.706  |



Budget Activity #4 - Tactical Programs

Program Element #6.43.06.A

Title STINGER

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. Development contractor - General Dynamics.

b. STINGER is a shoulder fired, passive infrared homing guided missile with an Air Defense mission. Total weight of the missile and its launcher in the ready-to-fire configuration is 33.4 pounds. The fire unit will be a two-man team, authorized a basic load of six missiles.

c. Development Test (DT) I. There were no systems tests in Advanced Development. Component tests were run to verify feasibility of improvements to REDEYE and concept of Second generation IR seeker.

d. Development Test (DT) II. The following are completed or planned.

| Type of Test   | Number of<br>Missiles | Completion<br>Date |
|--|-----------------------|--------------------|
| (1) Eject Test Vehicles                                      | 10                    | Oct 73             |
| (2) Launch Test Vehicles                                     | 7                     | Aug 73             |
| (3) Control Test Vehicles                                    | 6                     | Sep 74             |
| (4) Guided Test Vehicles                                     | 16                    | Jul 75             |
| (5) Design Test Vehicles                                     | 18                    | Jan 76             |
| (6) Prototype Qualification Test-<br>Contractor              | 26                    | Oct 76             |
| (7) Prototype Qualification Test-<br>Government              | 84                    | Feb 77             |
| (8) Prototype Qualification Test-<br>Government (Additional) | 18                    | Aug 77             |

Technical problems experienced during the Guided Test Vehicle Series were in guidance and propulsion. The second half of that series was the corrected configuration. Their success demonstrated corrective actions were proper. This was further demonstrated by the Design Flight (DF) Test program. Prototype Qualification Tests-Contractor has further demonstrated design maturity. Manufacturing process problems (Quality Control) were experienced initially in laboratory environmental tests. Corrective action was proven adequate in subsequent tests. Total system performance will be demonstrated in DT II. Eighteen additional Prototype

Budget Activity #4 - Tactical Programs

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Title STINGER

Qualification Test rounds have been added to confirm the production configuration resulting from Prototype Qualification Tests-Government. A non-firing contractor demonstration was conducted Jan/Mar 75. This consisted of field handling and tracking tests within an operational scenario. Operational Test and Evaluation Agency (OTEA) assisted in test design and observed conduct of the test. Operationally critical issues were addressed to verify attainment of significant weapon system characteristics. Additional non-firing demonstration tests were conducted in Federal Republic of Germany (FRG) in June 1976. These tests demonstrated the system effectiveness in a typical European environment.

e. Development Test (DT) III. 50 missiles are planned for tests in July 1978 from LRIP procurement. The necessity of this large test program will be completely evaluated upon completion of DT II.

2. Operational Test and Evaluation:

a. Operational Test I (OT I) was not conducted. Instead, OTEA monitored the contractor demonstration at Ft. Bliss, TX, during Jan-Mar 75. The objectives of the contractor demonstration were to demonstrate to a limited degree, the capability of the system utilizing a STINGER Tracking Head Training device in areas such as:

(1) Human factors and weapon performance effectiveness.

(2) Preliminary weapon system reaction times of the weapon and associated command, control and communications, early warning and employment/deployment doctrine.

b. Operational Test II (OT II) was conducted by OTEA independent of DT II. OT II was carried out in two subtests. Subtest #1 was a team level operational non-fire exercise at Ft. Carson, CO, during Aug-Sep 76. Subtest #2 was a section-level operational live fire exercise using eleven prototypes at White Sands Missile Range, NM, during Oct 76 using the same soldiers as employed in Subtest #1.

c. Operational Test III (OT III) is planned as an independent test consisting of two subtests. The first is scheduled for ten days at White Sands Missile Range (WSMR), NM, and will be a live fire exercise employing thirty-two limited production weapons firing by STINGER/REDEYE teams. A follow-on six day non-fire operational exercise will be conducted at Ft. Carson, CO, using the same teams. Both subtests are planned for completion by June 1979. Necessity of this complete test program will be evaluated upon completion of DT/OT II.

Budget Activity #4 - Tactical Programs

Program Element # 6.43.06.A

Title STINGER

3. (C) System Characteristics:

Operational/Technical  
Characteristics

- a. Maximum Target Speed
- b. Maximum Intercept Range
- c. Intercept Altitude (Min/Max)
- d. Reliability
- e. Weight
- f. Infrared Countermeasures (IRCM) 1/
8. IFF MARK XII 2/

Objectives



10 km

Demonstrated  
Performance  
(DISE)



10 km

- 1/ Maximum system performance degradation in a countermeasures environment.
- 2/ Maximum range at which operator may challenge aircraft.
- 3/ Achieved against some but not all IRCM.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6,43,07.A

Title PATRIOT (SAM-D)

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/ ( \$ in Thousands)

| Project Number | Title                      | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|----------------------------|---------|---------|---------|---------|--------------------------|----------------------|
| D212           | TOTAL FOR PROGRAM ELEMENT  | 130,000 | 40,000  | 214,558 | 210,027 | 123,303                  | 1,753,705            |
|                | Quantities                 |         |         |         |         |                          |                      |
|                | Fire Control Section (FCS) |         |         |         |         |                          | 5                    |
|                | (MsIs) Missiles            |         |         |         |         |                          | 129                  |

Procurement:

Total Quantities  
(FCS's)  
(MsIs)

65,200 4,110,300 4,175,500

Military Construction:

12,776

BRIEF DESCRIPTION OF ELEMENT: PATRIOT (SAM-D) is an advanced surface-to-air guided missile system with a high single shot kill probability capable of operation in an electronic countermeasures (ECM) environment, and able to conduct multiple simultaneous engagements against the high performance air-breathing targets likely to be encountered by deployed United States forces during the 1980's and beyond. In the field Army, PATRIOT (SAM-D) defenses will be complemented by short range, low altitude forward area air defense weapons and will be integrated with the US Air Force in the overall air defense of the theater of operations.

BASIS FOR FY 78 RDTE REQUEST: Flight test engineering development model (EDM) and modular digital airborne guidance (MDAG) missiles from Fire Section (FS) #2. Deliver FS #3; FS #4 undergoing factory checkout. Initiate Producibility Engineering Planning.

BASIS FOR INCREASE IN FY 1978 OVER FY 1977: Phased buildup due to resumption of Engineering Development in 7T, plus initiation of Producibility Engineering and Planning (PEP).

Budget Activity #4 - Tactical Programs

Program Element #6.43.07.A Title PATRIOT (SAM-D)

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                                | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |                                    | <u>FY 1977 and Prior</u> | <u>FY 1978</u> | <u>Total</u> |
|--------------------------------|-------------|--------------------|--------------|------------------------------------|--------------------------|----------------|--------------|
| (1) Federal Civilian Employees | 884         | 0                  | 884          | (1) Estimated Government Liability |                          |                |              |
| (2) Contractor Employees       | 2,756       | 0                  | 2,756        | Financed with:                     | 1,206,100                | 25,000         | \$1,231,000  |
| Total                          | 3,640       | 0                  | 3,640        |                                    |                          |                |              |

TERMINATION COST: (\$ in Thousands)

DETAILED BACKGROUND AND DESCRIPTION: PATRIOT (SAM-D) will replace NIKE HERCULES and Improved HAWK in providing improved Army air defense. In the field Army, PATRIOT (SAM-D) defenses will be complemented by short range, low altitude forward area air defense weapons and will be integrated with the US Air Force in the overall air defense of the theater of operations. The advanced features of PATRIOT (SAM-D) will provide an increased capability against saturation attacks, electronic countermeasures (ECM), and maneuvering targets. It will also provide a reduction in manpower and logistical requirements. The PATRIOT (SAM-D) requirement evolved from the need for an advanced surface-to-air guided missile system with a high single shot kill probability capable of operation in an ECM environment, and able to conduct multiple simultaneous engagements against the high performance air-breathing targets (ABT) likely to be encountered by deployed United States forces during the 1980's and beyond. To cope with the projected threat, PATRIOT (SAM-D) will utilize a trainable, multifunction, electronically-scanned phased array radar. In addition, a digital computer will be used to automatically control the system functions as well as to provide the operator, through various displays, the ability to control and monitor operations. The guidance system combines command and homing guidance (track-via-missile - TVM) systems. In January 1974, the Deputy Secretary of Defense directed the Army to reexamine and redirect the SAM-D (now PATRIOT) program to emphasize greater austerity and permit early flight verification of the guidance concept. A new cost effectiveness study was undertaken due to the concern expressed by the Congress and the Office of Management and Budget (OMB) on the projected system cost and the complexity of the advanced technology involved. The cost-effectiveness study concluded that the technological characteristics embodied in the PATRIOT (SAM-D) system assure that the cost effectiveness of such a system will be superior to those of the other, older, less capable high medium altitude air defense systems. A meeting of the Defense System Acquisition Review Council (DSARC) was held on 6 June 1974 to review the reoriented PATRIOT (SAM-D) program. On 27 June 1974, the Deputy Secretary of Defense approved the continuation of the RDTE program for a system to replace NIKE HERCULES and Improved HAWK. The following activities were approved for funding: (1) Track via Missile (TVM) Proof-of-Principle (POP) tests; (2) minimum PATRIOT (SAM-D) development to permit continuation of full-scale development after successful completion of POP; (3) cost reduction efforts; and (4) a complementary effort to examine backup guidance concepts as insurance against TVM failure during POP tests. The POP tests were successfully completed and ASARC/DSARC decisions in January 1976 approved the program to resume full-scale Engineering Development. On 4 August 1976, a contract to complete the contractor portion of the PATRIOT (SAM-D) system was awarded to Raytheon Company, the prime contractor.



**Budget Activity #4 - Tactical Programs**

Program Element #6.43.07.A Title PATRIOT (SAM-D)

RELATED ACTIVITIES: System commonality with the Navy AEGIS has been studied and although separate developments are required, continuous coordination insures the use of common components whenever feasible. The PATRIOT system will be interoperable with other Group/Brigade level command and control systems (TSQ-73) and with other service air defense command and control elements, AWACS.

WORK PERFORMED BY: The Raytheon Company of Bedford, Massachusetts is prime contractor with Martin-Marietta Corporation of Orlando, Florida, as missile subcontractor. Thiokol Chemical Corporation of Huntsville, Alabama, is a subcontractor for the rocket motor. IBM Corporation of Huntsville, Alabama, is the System Engineering Cost Reduction Assistance Contractor (SECRAC).

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1973, FY 1976, and Prior Accomplishments: The project was initiated as the Army Air Defense System for the 1970's (AADS-70's) in 1963. Feasibility and trade-off studies were conducted in FY 1963 and FY 1964. The program was reoriented and renamed SAM-D in FY 1965. Contract Definition was completed and a contract for Advanced Development (AD) was awarded in May 1967. SAM-D hardware was designed, fabricated, and tested. The Advanced Development program proved the ability of the multi-function phased array radar to carry out time-shared search and track functions under computer control. Performance was demonstrated by tracking tests on 112 controlled aircraft targets and a multitude of targets of opportunity in 164 hours of testing. Radar tests included waveform diversity, frequency agility, stability, and noise characteristics, output power and duty cycle. Missile parameters such as chamber pressure, temperature, aeroballistics, and control systems were verified by eight propulsion and control test flights. The airborne guidance section was tested in over 100 captive flight tests. Flights were conducted against single and multiple targets in both clutter and electronic countermeasure environments. The Guidance Test and Simulation Facility was built and computer simulated flights were compared to results of propulsion, control, and captive flights. As a result of the successful completion of Advanced Development objectives, PATRIOT (formerly SAM-D) was approved for entry into Engineering Development (ED) in March 1972. ED efforts proceeded in three main areas: (1) Advanced Development (AD) ground support hardware was modified to allow its use as a demonstration fire section; (2) design and fabrication of Engineering Development (ED) model missiles; and (3) design and fabrication of ED fire sections. The SAM-D Nuclear and Antimissile Capability Study was approved in December 1972. This study recommended: (1) deletion of the nuclear warhead, (2) programming of reduced number of fire sections for CONUS air defense, and (3) development of an improved non-nuclear warhead. The program was reoriented on 10 January 1974 to emphasize greater austerity while permitting early flight verification of the track-via-missile (TVM) guidance principle. A stop work order was issued to the prime contractor on 4 February 1974. As a result of this order, all effort in support of a major portion of the hardware development (two (2) fire control sections, two (2) launching stations, one hundred five (105) missiles, command and coordination groups and communications replay groups) and some engineering activities were deferred until a Defense System Acquisition Review Council (DSARC) met to approve the reoriented program. On-going efforts remaining after the stop work order were in support of the TVM demonstration and an austere development program. An austere version of SAM-D, termed Medium SAM, was defined for use in the cost and operational effectiveness analysis. The austere SAM-D

Budget Activity #4 - Tactical Programs

Program Element #6.43.07.A

Title PATRIOT (SAM-D)

definition was further refined through a joint user/developer effort. Two shortburn and 9 of 10 controlled test vehicle (CTV) missile firings were conducted. The DSARC met on 6 June 1974 to review the reoriented program. In accordance with the Deputy Secretary of Defense directive, based on the Defense System Acquisition Review Council (DSARC) recommendations, program efforts continued in the following areas: (1) preparation for the track-via-missile (TVM) demonstration flights; (2) continuation of the austere development program; (3) initiation of cost reduction; and (4) development of a backup guidance. The final control test vehicle (CTV) flight was completed on 28 August 1974. Of the 10 flights, were rated as successes with full accomplishment of flight objectives designed to checkout the rocket motor, the missile aerodynamics, and the control surfaces at different Mach numbers and altitudes. The major objectives of the captive carry flight test program, a prerequisite to the Engineering Development Missile (EDM) #1 flight, were successfully demonstrated and repeated during November 1974. Proof-of-Principle flight tests demonstrated, through missile firings, that TVM guidance functions successfully against benign targets which are maneuvering, in formation, and at low altitudes. Sixteen missiles were originally allocated for these tests. This was reduced to 14 because of the success of the flights. Consecutive successful flight tests proved the principle of track-via-missile; the remaining were used to obtain additional engineering data. A complementary effort is no longer being pursued. Engineering Development Model Firing Platoon (FP#1) is undergoing final checkout at White Sands Missile Range (WSMR), New Mexico, for use in flight test program in FY 1977. Cost reduction efforts continue to include the assistance provided by the System Engineering Cost Reduction Assistance Contractor (SECRAC). An ASARC/DSARC was held in January 1976 which allowed the resumption of full-scale Engineering Development and in August 1976, a contract was signed with the prime contractor to complete his portion of Engineering Development. In May 1976, the name of the project was changed from SAM-D to PATRIOT.

2. FY 1977 Program: Eighteen Engineering Development Model (EDM) missiles produced as part of Phase II effort will be flight tested during this FY using Fire Control Sets (FCS's) #1 and #2. The balance of Phase II missiles are scheduled for flight testing in the next fiscal year fabrication and assembly of Phase III Modular Digital Airborne Guidance Section (MDACS) missiles, which began in FY 77, will continue. These missiles will support ground tests and firings in following fiscal years. Fire Control Sets (FCS's) #1 and #2, built in Phase II, will be used to support the EDM missile firing program. FCS #1 is scheduled for nine missile firings before being shipped to Raytheon to be disabled and updated for use in building FCS #3. FCS #2 is scheduled for eleven missile firings in this fiscal year. Fabrication and assembly will continue on Phase III FCS's #3, #4, and #5 for delivery in later fiscal years. Launching Station (LS's) #1 and #2, built in Phase II, will be used in conjunction with FCS's #1 and #2 in EDM missile flight program. LS #1 will be updated and designated LS #3. Fabrication and assembly will continue on Phase III LS's #4 and #5 for delivery in later fiscal years. Command and Coordination Group (CCG) design will be in the final stages of completion, with fabrication of low level items initiated on one CCG for delivery in support of the Development Testing/Operational Testing (DT/OT) tests will complete design and begin assembly of Battalion Supply and Maintenance Equipment (BSME) #1 and #2 for delivery in following fiscal years and will design and fabricate one Communications Relay Group (CRG) for delivery to WSMR in FY 79. Cost reduction efforts will continue to include the assistance provided by the System Engineering Cost Reduction Assistance Contractor (SECRAC).

#### Budget Activity #4 - Tactical Programs

Program Element #6.43.07.A Title PATRIOT (SAM-D)

3. FY 1978 Planned Program The remaining engineering development model (EDM) missiles produced in Phase II are scheduled to be flight tested during this fiscal year using Fire Control Set (FCS) #2. Eight MDAGG forebodies (TVM Guidance Section and Warhead Section, less Warhead and Safe and Arming Device), are scheduled to be delivered with three allocated for ground tests and allocated for the first MDAGS flights. FCS #2 will be used to support the missile firing program. FCS #3, updated from FCS #1, will be shipped to White Sands Missile Range (WSMR) for use in flight test program in FY 79. FCS #4 fabrication and assembly will be completed and undergo climatic testing at contractor's plant prior to shipment to WSMR in FY 79 for use in flight test program. FCS #5 will be in the final stages of assembly prior to undergoing Army climatic tests in FY 79. Launcher Station (LS) #1, updates and designated as LS #3, will be shipped to WSMR for use in flight test program during future fiscal years. LS #3 and LS #4 will be used in conjunction with FCS #3 and #4 in missile flight test program. LS #5 will undergo climatic tests with FCS #5. Command and Coordination Group (CCG) will be nearing completion of fabrication and assembly; scheduled for delivery to WSMR in early FY 79. Battalion Supply and Maintenance Equipment (BSME) #2 will be in final states of assembly prior to delivery in early FY 79. Communications Relay Group (CRG) will be in final stages of assembly prior to delivery in early FY 79. Producibility Engineering Planning (PEP) will be initiated this fiscal year.

4. FY 1979 Planned Program: Thirteen Modularized Digital Airborne Guidance System (MDAG) missiles are scheduled to be flight tested as the conclusion of the contractor flight test program. MDAG missiles are scheduled to be flight tested as the start of Development Test/Operational Test II (DT/OT II). FS #3 and #4 will support the firing programs during this year. FS #5 will continue to undergo Army climatic tests during this fiscal year. All other ED ground equipment is scheduled for delivery. PEP activities will continue toward preparing the system for production.

5. Program To Completion: Development Testing/Operational Testing (DT/OT) II is scheduled to be completed in FY 1980, with the Missile Procurement, Army (MIPA) program leading to an initial operation capability in January 1984.

#### 6. Major Milestones:

| First Electronic Countermeasures (ECM) Flight<br>Delivery of FCG-2 to White Sands Missile Range (WSMR)<br>Modularized Digital Airborne Guidance System (MDAGS) engineering<br>model available for use   | Date            | Estimated RDTE Cost to<br>Reach Events (Cumulative) |
|---|-----------------|---|
|   |                 |   |
| Completion of Phase II ECM-electronic countermeasures Search/Track (S/T) Tests<br>Start of Producibility Engineering and Planning (PEP)<br>Delivery of FCG-3 to White Sands Missile Range (WSMR)<br>First Modularized Digital Airborne Guidance System (MDAGS) Flight<br>Delivery of FCG-4 to White Sands Missile Range (WSMR)<br>Contractor Flight Tests Completed and Start of DT/OT testing<br>Completion of DT/OT testing | Prior to Oct 76 | 1,026M (Sunk)                                       |
|   | Dec 76          | 1,080M  |
|   | Feb 77          | 1,311M  |
|   | Mar 77          | 1,330M  |
|   | Jun 77          | 1,376M  |
|   | Oct 77          | 1,448M  |
|   | Sep 78          | 1,637M  |
|   | Oct 78          | 1,648M  |
|   | Jan 79          | 1,677M  |
|   | Jul 79          | 1,723M  |
|   | May 80          | 1,754M  |

Budget Activity #4 - Tactical Programs

Program Element #6.43.07.A Title PATRIOT (SAM-D)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation

- a. The Initial Advanced Development (ADDEV) contract was awarded to Raytheon Company of Bedford, Massachusetts, in May 1967. The primary objective of the advanced development (AD) program was to define a low risk engineering development (ED) program by minimizing the technical risks. Emphasis was placed on demonstrating those system elements unique to PATRIOT, in particular, the hardware elements associated with the conduct of engagements and the operational software necessary to control the operations of the hardware elements in all air defense functions from target detection through intercept. As a result of the successful AD program, the Deputy Secretary of Defense approved PATRIOT entry into ED and a contract was executed with Raytheon Company on 31 March 1972. The ED program was interrupted in January 1974 in order to demonstrate the Track-Via-Missile (TVM) guidance concept through the Proof-Of-Principle firing program.
- b. Phase I system demonstration firings were initiated in February 1975. This firing phase, comprised of fourteen (14) missiles, demonstrated Proof-Of-Principle of the Track-Via-Missile guidance, the guidance modes and fuzing functions. As a pre-requisite to the live firings, Captive Carry Flight Tests were conducted. These tests used an abbreviated missile (without rocket motor) mounted on an aircraft to simulate the free space guidance conditions of a missile intercepting a target. Due to the outstanding success of the missile firings, the OSD objectives of Proof-Of-Principle demonstration were met with the first PATRIOT guided missile flights against target aircraft. The target conditions included non-maneuver, high "g" maneuver, formation, short range and low altitude in a benign environment. Five (5) additional engineering evaluation firings were performed against targets of very low altitude, high altitude, high speed, very long range and high clutter conditions. An additional three (3) missiles were fired as control test vehicles to complete the matrix of missile aerodynamic data. At the conclusion of Proof-Of-Principle firings, full ED status was restored.
- c. Phase II tests will demonstrate system performance in various electronic countermeasures (ECM) environments. Extensive search/track tests will be conducted to exercise the system against various ECM and target scenarios. Eleven (11) missile firings are scheduled against targets of various intercept geometries in the presence of stand-off-jammers, barrage jammers, deceptive jammers and chaff. Multiple simultaneous engagements will be performed to demonstrate the capability to control multiple missiles in terminal guidance while simultaneously continuing surveillance functions.
- d. Phase III will continue missile flights in electronic countermeasures (ECM) environments in addition to system environmental and battalion tests. Thirty (30) missiles are scheduled to be fired by the Contractor and an additional forty (40) by the Government to complete the PQT firing program. Environmental tests will be performed to determine the effects of natural and induced environments. This testing will cover mobility, transportability, chemical, biological, climatic, altitude, electromagnetic radiation and electromagnetic pulse environments. Battalion tests will be performed to demonstrate that system requirements have been met, evaluate troop proficiency and demonstrate the system's capability in a variety of deployments and environments.



Budget Activity #4 - Tactical Programs

Program Element #6.43.07.A Title PATRIOT (SAM-D)

Prototype Qualification Tests by the Government (PQT-G) will measure the technical performance of the system and determine the degree to which the performance meets stated specifications or characteristics. Military personnel will be incorporated into the program in order to assess these critical man-machine interfaces. The Government will monitor and participate in the Contractor Prototype Qualification Testing (PQT-G) in order to satisfy as many PQT-G requirements as practicable to preclude duplicative testing. PQT-G and Operational Test (OT) II evaluators will also share equipment and test data for independent evaluation.

e. Development Test III (DT III) will be conducted to assure that initial production run equipment meets the specifications and development plan characteristics, and to insure the quality of production materiel.

2. Operational Test and Evaluation:

a. The Operational Testing and Evaluation Agency (OTEA) will schedule and conduct Operational Test II (OT II) and Operational Test III (OT III). Ground equipment used for OT II will be common to that used for DT II. Eight of the above mentioned forty missiles are designed to be fired under the control of OTEA. An independent evaluation will be provided by OTEA to the decision review prior to the production decision.

b. OT II will be conducted at White Sands Missile Range (WSMR) on prototype equipment manned by user type troops. OT III will be conducted on production equipment manned by user troops. The location of OT III is to be determined.

3. System Characteristics:

Operational/Technical  
Characteristics

Firing Platoon Static Inherent Availability  
Missile Reliability (Launch and flight)  
Single Shot Kill Probability, PSSK (Reliable missile)

Objective

Demonstrated  
Performance 1/



Budget Activity #4 - Tactical Programs

Program Element #6.43.07.A

Title PATRIOT (SAM-D)

Operational/Technical  
Characteristics

Demonstrated  
Performance 1/

Objective

Max Intercept                      (Alt/Rg) (km)  
Max 90J Intercept Range (km)  
Max Inner Intercept Dead Zone (cyl rad about ea launcher group  
and fire control section) (km)  
Number Simultaneous Engagements/Firing Platoon  
Max Number Simultaneous Target Tracks/Fire Control Sec (FCS)  
Max Target Detection Range  
Reaction Time (auto mode) (sec) m)



- 1/ To be demonstrated during operational testing.
- 2/ Single Shot Engagement Kill Probability
- 3/ Standoff Jammer
- 4/ Effective Radiated Power

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element # 6.43.08.A

Title Precision Laser Designator

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities   | 7700    | 6350    | 5326    | 3993    | 1400                     | 42104                |
| D075           | Ground Laser Locator Designator (GLLD) | 7700    | 4350    | 4091    | 2693    | 800                      | 36969                |
| DE30           | Protective Laser Devices               | 0       | 2000    | 1235    | 1300    | 600                      | 5135                 |
| Procurement:   |  |         |         |         |         |                          |                      |
|                | Funds                                  | 0       | 0       | 14500   | 14900   | 67400                    | 96800                |
|                | Quantities                             |         |         | 50      | 130     |                          |                      |

BRIEF DESCRIPTION OF ELEMENT: This program element provides for the development of a precision laser designator to be used in either a ground tripod or vehicular mounted configuration. The GLLD provides the capability for long range precision designation of either stationary or moving tank sized targets to allow a high probability of a first round kill with laser guided weapons such as the Cannon Launched Guided Projectile (COPPERHEAD) and the helicopter missile - HELLPRE, and determination of target bearing and range relative to the GLLD to enhance conventional artillery effectiveness against stationary and moving targets. A second project within this program element includes spoofer - a device which simulates the laser designator - and a periscope adaptation for the GLLD.

Budget Activity #4 - Tactical Programs

Program Element # 6.43.08.A Title Precision Laser Designator

BASIS FOR FY 1978 RDTE REQUEST: The Ground Laser Locator Designator (GLLD) engineering development contract will continue through August 1978. Plans will be completed for a production contract award during the first quarter. Work will continue on the vehicle mount for GLLD. Continuation of the alternate source laser designator/rangefinder will depend upon the success of the prime contractor in solving the GLLD technical problems. Work will continue on the spoofer and periscope.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The decrease in funding is because of reduced engineering development efforts for the spoofer and periscope and completion of the GLLD engineering development contract.

PERSONNEL IMPACT: The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 38   | 0           | 38    |
| (2) Contractor Employees   | 28   | 65          | 93    |
| Total                      | 66   | 65          | 131   |

DETAILED BACKGROUND AND DESCRIPTION: This program element was initiated in FY 1974 to provide for engineering development of precision laser designators to be used in conjunction with laser guided weapons of all Services. The GLLD consists of a laser designator/rangefinder, day sight, tracking unit and mount. It also has an interface for mounting a night observation device. The system weighs 52 pounds; determines target bearing; designates moving targets, visible through the optics, to ranges to targets at distances up to 10 miles.

The primary user of the GLLD is the Artillery forward observer. In a mounted configuration it will also be used by maneuver units. The development of a spoofer and periscope within this program is intended to enhance the survivability of the designator operator. The use of low cost spoofers will confuse an enemy searching for the position of the laser designator. A periscope adaptation for the GLLD will reduce the operator's exposure to enemy counterfire.

RELATED ACTIVITIES: The US Navy, Air Force, and Marine Corps use the same technologies in their laser homing weapons system programs. There is close coordination between the services, to include technology working groups and tri-service agreements, to provide exchange of technology efforts, to allow use of common components/or equipments, where practical, and insure system compatibility in the field. The Army has been designated the lead service for the development of all ground laser designators. Army ground laser designators have supported live firings of the Navy's 8-inch guided projectile program, the Navy's BULLDOG missile, the Air Force Close Air Support Missile, and the Army's HELIFIRE and CLAP programs. The Air Force is considering the use of the GLLD for its tactical air control parties. The US Army Missile Research and Development Command is also developing a laser target designator (LTD) under program element 6.47.23.A, Project DL84, Special Purpose Detectors, Laser Target Designator, and a Modular

**Budget Activity #4 - Tactical Programs**

Program Element # 6.43.08.A

Title Precision Laser Designator

Universal Laser Equipment (MULE) for the USMC under program element 6.47.65M, Modular Universal Laser Equipment. The MULE is essentially a tripod mounted version of the Laser Target Designator (LTD) with components of the Army's AN/GVS-5 laser rangefinder integrated into the system. The MULE shares parts commonality with the LTD and AN/GVS-5 in excess of 80%.

**WORK PERFORMED BY:** In-house work is performed by the US Army Missile Research and Development Command, Huntsville, AL. The contractor for the engineering development model of the GLD is Hughes Aircraft Company, Culver City, CA. Additional contractual work is being performed by International Laser Systems, Orlando, FL.

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. FY 1977, FY 1976, and Prior Accomplishments: Breadboard models of GLD were fabricated under exploratory development programs to establish the feasibility of precisely guiding munitions to a point target by means of a laser designator employed from a remote location. Competitive advanced development contracts were awarded for fabrication of a tripod mounted precision laser designator. A Laser Guided Missile Military Potential Test was conducted at Fort Hood, TX. The results verified the feasibility and military potential of the terminal homing weapon system concept. Following a successful advanced development phase, an engineering development contract was awarded to Hughes Aircraft Company in April 1974 for 22 prototype models. During FY 1975, the GLD was used in live fire testing of COPPERHEAD and HELLFIRE. The US Army Operational Test and Evaluation Agency tested the GLD extensively during the CLGP Operational Test I with very favorable results. The GLD also participated in the Joint Service Evaluation of Laser Guided Weapons in Close Air Support and the Field Experiment of Designator Survivability, both conducted at Fort Hood, TX. Fabrication of feasibility models of a vehicle mount, spoofer, and periscope was begun. Delivery of engineering development models of GLD began during second quarter, FY 1976. Technical problems associated with beam divergence at extreme temperature limits were experienced which delayed the start of operational testing. To insure GLD availability by CLGP fielding, an alternate source laser designator/rangefinder (LDR) contract was awarded to International Laser Systems for three LDR models. Feasibility models of the vehicle mount, spoofer, and periscope were fabricated.

2. FY 1977 Program: Delivery of the engineering development models of the GLD and the alternate source LDR will begin first quarter. Extensive testing and evaluation will follow, and a decision will be made regarding continuation of the alternate source LDR contract. Operational testing of the GLD will begin fourth quarter. The initial phase of this test will include the use of laser guided bombs. The feasibility models of the vehicle mount, spoofer, and periscope will be evaluated as a part of the GLD operational test. Several of the GLD's will be used in support of COPPERHEAD and HELLFIRE testing.

Budget Activity #4 - Tactical Programs

Program Element # 6.43.08.A

Title Precision Laser Designator

3. FY 1978 Planned Program: The Ground Laser Locator Designator (GLLD) operational test will be completed. The GLLD will be type classified and a production contract awarded. The engineering development contract will be concluded. A product improvement effort will begin to incorporate technology advances into the GLLD which occur during the three year period following the engineering development design freeze. Areas in which significant advances are expected include batteries, laser material efficiency, coding, flashlamp life, optical coating and component reliability. A laser terminal homing system trainer and a mount to transport the GLLD in a ready to use configuration on selected vehicles will be developed. Engineering development models of the spoofer and periscope will be developed. The decrease in FY 1978 funding as compared with FY 1977 is because of development efforts for the spoofer and periscope and completion of the GLLD engineering development contract.
4. FY 1979 Planned Program: Product improvement efforts will continue. Engineering development of spoofer and periscope will be completed. Support of terminal homing munitions tests will continue. The decrease in FY 1979 funding as compared with FY 1978 is caused by the completion of contractual work in the GLLD.
5. Program to Completion: Product improvement efforts and engineering support will continue. Support of terminal homing munitions tests will continue. Testing of spoofer and periscope will be completed in FY 1980.



FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.43.08.A

Title Precision Laser Designator

Project #D075

Title Ground Laser Locator Designator (GLLD)

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: This project was initiated in FY 1974 to provide for engineering development of precision laser designators to be used with laser guided weapons of all Services. The Ground Laser Locator Designator (GLLD) consists of a laser designator/rangefinder, day sight, tracking unit, and mount. It also has an interface for mounting a night observation device. The primary user is the Artillery Forward Observer. The system weighs 52 pounds; determines target bearing; designates moving targets, visible through the optics, to and ranges to targets at distances of In a mounted configuration, it will also be used by maneuver units.

RELATED ACTIVITIES: The US Navy, Air Force, and Marine Corps use the same technologies in their laser terminal homing weapons system programs. There is close coordination between the services, to include technology working groups and tri-service agreements, to provide exchange of technology efforts, to allow use of common components or equipments, where practical, and insure system compatibility in the field. The Army has been designated lead service for the development of all ground laser designators. The US Army Missile Research and Development Command is developing the GLLD, a lightweight laser designator (LMLD) under program element 6.47.23.A, project DL71, Special Purpose Detectors Low Energy Laser Device, and a Modular Universal Laser Equipment (MULE) for the Marine Corps under program element/project 6.47.65M, C0027, Modular Universal Laser Equipment. The MULE is essentially a tripod mounted version of the LMLD with components of the Army AN/GVS-5 laser rangefinder integrated into the system. The MULE shares 70-80% parts commonality with the LMLD and AN/GVS-5. Army ground laser designators have supported live firings of the Army HELLFIRE and COPPERHEAD programs, the Navy 8-inch guided projectile program and the BULLDOG missile, and the Air Force Close Air Support Missile. The Air Force is considering the use of the GLLD for its tactical air control parties.

WORK PERFORMED BY: In-house work is performed by the US Army Missile Research and Development Command, Redstone Arsenal, AL. The engineering development contractor is Hughes Aircraft Company, Culver City, CA. Additional contractual work is being performed by International Laser Systems, Orlando, FL.

Budget Activity #4 - Tactical Programs

Program Element #6.43.08.A

Title Precision Laser Designator

Project #D075

Title Ground Laser Locator Designator (GLLD)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Prototype models of GLLD were fabricated under exploratory development programs to establish the feasibility of precisely guiding munitions to a point target by means of a laser designator employed from a remote location. Competitive advanced development contracts were awarded for fabrication of a tripod mounted precision laser designator. A Laser Guided Missile Military Potential Test was conducted at Fort Hood, TX which verified the feasibility and military potential of the terminal homing weapon system concept. An engineering development contract was awarded to Hughes Aircraft Company in April 1974. During FY 1975, the GLLD was used in live fire testing of COPPERHEAD and HELLFIRE. The US Army Operational Test and Evaluation Agency tested the GLLD extensively during the COPPERHEAD Operational Test I with very favorable results. The GLLD also participated in the Joint Service Evaluation of Laser Guided Weapons in Close Air Support and the Field Experiment of Designator Survivability, both conducted at Fort Hood, TX. Delivery of engineering development models began during second quarter, FY 1976. Technical problems associated with beam divergence at extreme temperature limits were experienced which delayed the start of operational testing. To insure GLLD availability by COPPERHEAD fielding, an alternate source laser designator/rangefinder (LDR) contract was awarded to International Systems for three LDR models.
2. FY 1977 Program: Delivery of the engineering development models of the GLLD and the alternate source LDR will begin first quarter. Extensive testing and evaluation will follow, and a decision will be made on continuation of the alternate source LDR contract. Operational testing will begin fourth quarter. The initial phase of the test will include the use of laser guided bombs. Several of the GLLD's will be used in support of COPPERHEAD and HELLFIRE testing.
3. FY 1978 Planned Program: The GLLD operational test will be completed. The GLLD will be type classified and a production contract awarded. The engineering development contract will be concluded. A product improvement effort will begin to incorporate technology advances which occur during the three year period following the engineering development design freeze. Areas in which significant advances are expected include batteries, laser material efficiency, coding, flashlamp life, optical coating and component reliability. A laser terminal homing system trainer and a mount to transport the GLLD in a ready to use configuration on selected vehicles will be developed. The decrease in FY 1978 funding as compared with FY 1977 is because of completion of the prime engineering development contract.
4. FY 1979 Planned Program: Product improvement efforts will continue. Support of terminal homing munitions tests will continue. The decrease in FY 1979 funding as compared with FY 1978 is due to completion of contractual work on the GLLD.
5. Program to Completion: Product improvement efforts, engineering support, and support of terminal homing munitions tests will continue into FY 1980.

Budget Activity #4 - Tactical Programs

Program Element #6.43.08.A

Project #D075

RESOURCES: (\$ in Thousands)

Title Precision Laser Designator

Title Ground Laser Locator Designator (GLLD)

|                    | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional<br/>to<br/>Completion</u> | <u>Total<br/>Estimated<br/>Cost</u> |
|--------------------|----------------|----------------|----------------|----------------|---|-------------------------------------|
| RDTE: Funds        | 7700           | 2200           | 4091           | 2693           | 800                                     | 36969                               |
| Quantities         |                |                |                |                |   | 25                                  |
| Procurement: Funds | 0              | 0              | 14500          | 14900          | 67400                                   | 96800                               |
| Quantities         |                |                | 50             | 130            |   |                                     |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.43.09.A

Title ROLAND

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT | 54965   | 11510   | 64003   | 19149   | 9861                     | 265000               |
|                | Quantities (Missiles)     |         |         |         |         |                          | 90                   |
| D647           | ROLAND                    |         |         |         |         |                          |                      |
| Procurement:   |                           |         |         |         |         |                          |                      |
|                | Funds                     | 0       | 0       | 67100   | 196700  | 1307900                  | 1571700              |
|                | Quantities (Missiles)     | 0       | 0       | 0       | 0       |                          |                      |

1/ Procurement funding reflects the purchase of ROLAND fire units and equipment for

BRIEF DESCRIPTION OF ELEMENT: This program will transfer the design of the French/German ROLAND II short range air defense (SHORAD) missile system to the US. A US version will be fabricated for testing and subsequently the US production base will produce ROLAND for use to meet the all-weather SHORAD missile requirement.

BASIS FOR FY 1978 RDTE REQUEST: \$64.0M in FY 1978 is needed to complete fabrication of four prototype US ROLAND fire units and 90 missiles and to purchase organizational maintenance test equipment and trainers from Europe to support Development Test/Operational Test (DT/OT) II. An integrated program of testing will be initiated in early FY 1978. This will include a joint US/European test in which both US and European missiles will be fired from a European production fire unit and it will include integrated development and operational testing using US fire units.

**Budget Activity #4 - Tactical Programs**

**Program Element #6.43.09.A**

**Title ROLAND**

**BASIS FOR CHANGE IN FY 1978 OVER FY 1977:** Decrease in funding is due primarily to completion of major technology transfer and fabrication efforts. During FY 1977 the technology transfer was completed and fabrication of prototype fire unit modules and carrier vehicles was begun. FY 1977 constituted a peak in program design transfer and fabrication effort. The FY 1978 funds will be devoted primarily to testing. Delivery of prototype fire units and missiles will occur early in the year and cooperative/Development Test/Operational Test II test activities which are somewhat less funding intensive will occupy the remainder of the year.

**TERMINATION COST: (\$ in Thousands)**

**PERSONNEL IMPACT:**

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |         |         |       |
|----------------------------|------|-------------|-------|---------|---------|-------|
| (1) Federal Civ. Employees | 127  | 0           | 127   | FY 1977 |         |       |
| (2) Contractor Employees   | 676  | 469         | 1145  | and     |         |       |
|                            |      |             |       | Prior   | FY 1978 | Total |
|                            | 803  | 469         | 1272  |         |         |       |
| Total                      |      |             |       |         |         |       |

(1) Estimated Government Liability  
Financed with: 172076 64003 236079

**DETAILED BACKGROUND AND DESCRIPTION:** The objective of this project is to transfer technology and fabricate hardware for the conduct of engineering development tests on a US built ROLAND air defense system. The ROLAND missile system will provide an all-weather Surface to Air Missile for use in defense of airbases, other rear area target complexes, and the system could defend divisional combat units. The ROLAND fire units will replace non-divisional CHAPARRAL/VULCAN units. The US ROLAND missile system will consist of a fire unit module (two missile launchers, internal missile storage compartment for 8 missiles, acquisition and tracking radar, and other fire control equipment) mounted on a single M-109 tracked vehicle. The system will engage low flying targets at ranges in excess of and up to in altitude. The missile may be launched in the optical mode (without using the tracking radar) or in the tracking radar mode for all-weather capability. At intercept, warhead detonation is initiated by a

**RELATED ACTIVITIES:** Evaluations to verify the technical performance of three foreign developed systems (the German/French ROLAND II, the United Kingdom RAPIER, and the French CROTALE) were conducted under Project D699 (Evaluation of Foreign Weapon Systems) of P.E. 6.33.01.A (Advanced Forward Area Air Defense Systems). Close liaison is maintained with the development/production efforts of the French/German ROLAND II program. The following US Army activities are monitored: (a) Department of the Army Program: CHAPARRAL (Program Element #2.37.30.A), (b) Program Element #6.23.03.A - Missile Technology.



Budget Activity #4 - Tactical Programs

Program Element #6.43.09.A

Title ROLAND

WORK PERFORMED BY: The program is managed by the US Army Missile Research and Development Command, Huntsville, Alabama. The prime contractor is Hughes Aircraft Corporation, Canoga Park, California. Boeing Corporation, Seattle, Washington, is the major subcontractor. Hughes and Boeing are the US co-licensees for Messerschmitt Bolkow Blohm, Munich, Germany and Aerospatiale of Paris, France.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments

The Short Range Air Defense Requirements Study concluded that

This requirement was approved by the Army in August 1973. The SHORAD missile program was approved by the Defense System Acquisition Review Council in February 1974. Four contractors responded to the Army's request for proposals: Philco-Ford for the all-weather CHAPARRAL missile system; Rockwell International for the CROTALE missile system; United Aircraft for the RAPIER system; and Hughes Aircraft for the ROLAND system. Hughes was awarded the contract on 9 January 1975 and initiated the transfer of design technology and fabrication of hardware. A cooperative test program was initiated with the German Government. This test was designed to reduce the risk of the engineering development phase by filling the gaps in the foreign testing. In August 1975 the US contractor, Hughes Aircraft Company, projected a cost growth in the Technology Transfer, Fabrication and Test contract. A special Army Systems Acquisition Review Council (ASARC) held on 17 October 1975 directed that the program be restructured to provide an opportunity for the European system design to stabilize and to provide an opportunity to reassess the US program. Hughes provided a revised cost proposal for a restructured contract modification. During FY 1976 the contractor's program was closely monitored by issuing funds in monthly incremental allotments sufficient to permit completion of the design transfer. Fabrication of electrical and mechanical subcomponents of the missile and fire units was begun. The cooperative test program was completed in February 1976 at Patrick AFB, FLA. During FY 1977 activities toward the fabrication of prototype hardware continued and the first prototype missile was completed. The restructured contract modification proposed by Hughes was negotiated in August 1976 and a special ASARC was held on 16 September 1976. The ASARC recommended continuation of the program to a special Defense Systems Acquisition Review Council (DSARC) which met on 24 September 1976.

2. FY 1977 Program: Subsequent to notification of the Congress, the Army initiated FY 1977 work based on the restructured program. Work was funded incrementally on a monthly basis through early CY 1977 when the program was to be presented for Congressional review. The Office of the Secretary of Defense approval of the DSARC recommendation was granted in December 1976. Design and fabrication of five modified M-109 tracked carriers was initiated and delivery is to be made within the year. Fabrication of the first US prototype fire unit, which was begun in FY 1976,

Fabrication of the prototype missiles was continued and four of the missiles were to be delivered to Euromissile (European contractor) for firing in the upcoming US/European Joint Test. Design of a US National Field Maintenance Test Set (FMTS), begun in FY 1976, continued. US/French/German agreement is to be obtained on a listing of ROLAND subsystems that will be internationally interchangeable.

# Budget Activity #4 - Tactical Programs

Program Element #6.43.09.A

Title ROLAND

1. FY 1978 Planned Program: In early FY 1978 the US and European governments will undertake a joint test of a European ROLAND II (all-weather) production model fire unit in the US. The test will involve both development and operational type testing at White Sands Missile Range and the fire unit will launch a total of US and European missiles. In the contractor will complete the first of four US prototype fire units and missiles qualified for flight. Contractor and government development/operational testing will be thoroughly integrated. Performance testing will include the firing of US missiles at field performance testing and environmental testing will extend into FY 1979. In early FY 1978 the first of two organizational maintenance test sets purchased in Europe will be delivered to support Development Test/Operational Test II. The first US Field Maintenance Test Set will be assembled and will be delivered in late FY 1978. In mid-FY 1978 Department of Defense will make a decision concerning release of procurement funds to establish Initial Production Facilities. Firm international configuration management will be initiated prior to the production decision to insure maintenance of international interchangeability. FY 1977 constituted a peak in program design transfer and fabrication effort. The decrease in funding from FY 1977 to FY 1978 is due primarily to completion of major technology transfer and fabrication activities.

2. FY 1979 Planned Program: The testing phase of the Technology Transfer, Fabrication and Test program will continue. Operational testing will be completed by mid-year. Tropic/arctic testing will be initiated early in FY 1979 and will continue throughout the year. A reduction in the FY 1978 funding level is due to completion of the major portion of government and operational testing in FY 1978 and early FY 1979. Based on approval of DSARC III low rate production will be initiated in early FY 1979.

3. Program to Completion: Low rate production (LRP) will continue and will produce sufficient fire units and missiles to establish initial operational capability (IOC) of the first equipment for training and the first

## 4. Major Milestones:

- a. Complete Cooperative Test
- b. Begin Prototype Qualification Tests (PQT-Contractor)
- c. Begin Joint Test Program
- d. DSARC III (decision on initial production facilities) and ultimate production)
- e. Complete temperate procurement qualification (PQT)/Operational (OT) testing
- f. Initial Operational Capability (IOC) of the first training battery

Estimated RDTE Cost to Reach Events (Cumulative)

|          |
|----------|
| \$ 57.2M |
| 183.2    |
| 194.2    |
| 210.7    |
| 244.6    |
| 265.0    |

Date

Budget Activity #4 - Tactical Programs

Program Element #6.43.09.A

Title ROLAND

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. The US contractor is Hughes Aircraft Company, Canoga Park, California.

b. The All-Weather (AW) Short Range Air Defense (SHORAD) missile system is the ROLAND II air defense system developed jointly by Germany and France. ROLAND is in pre-series production in Europe in a fair weather version (ROLAND I) and in pre-series production in Europe in the all-weather version (ROLAND II). A US test of the ROLAND II was concluded in the US in early 1973. This test verified the ability of the system.

The primary modification is repackaging the system into a module thus permitting its use on a US vehicle. In January 1975, the US Army entered into a cooperative test with Germany to obtain further test data on ROLAND II to aid the ROLAND program. The cooperative test employed German prototype hardware and the testing included performance evaluation. The European phase of the test occurred between January and July 1975. This phase included ROLAND I (fair weather version) performance testing. The US phase of the cooperative test was conducted between August 1975 and February 1976. This phase included training and performance testing involving ROLAND I and ROLAND II missile firings. The future test program for US ROLAND will completely integrate European, development and operational testing. This approach is intended to reduce test cost and schedule without sacrificing necessary test data. Prototype qualification testing at the contractors' plant will begin with US equipment in

2. Operational Test and Evaluation: The Operational Test and Evaluation Agency (OTEA) participated in the testing on the ROLAND II during the Cooperative Test in FY 1975. US and foreign crews were used during the test. OTEA will participate in tri-lateral joint testing in FY 1978 and is scheduled to conduct Operational testing (OT II) commencing in FY 1978. OTEA will provide an independent evaluation of the system prior to Low Rate Production. OTEA will participate in the confirmatory test on production models of the system in Operational testing will be conducted using US user personnel as operators. Reliability, availability, maintainability and supportability data will be obtained during all operational testing as well as during some developmental testing.

3. System Characteristics:

Operational/Technical Characteristics

Objectives

Demonstrated 1/

Target Intercept Range

Altitude

System Operational Effectiveness,

Benign/Electronic, Countermeasures

800-6000m

60-3000m

Budget Activity #4 - Tactical Programs


Program Element #6.43.09.A

Title ROLAND

Operational/Technical  
Characteristics

Target Speed Intercept Capability  
System Response Time (Target Acquisition to  
Msl First Motion)  
Reload Time (Magazine to Launcher)  
System Operational Availability  
March Order/Emplacement Time  
Air Transportability

Objectives

  
30 sec  
C-5

Demonstrated 1/

1/ Performance to be demonstrated during Integrated Development and Operational testing.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.43.10.A  
 Category Engineering Development  
 Title Heliborne Missile - HELLFIRE  
 Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 4000    | 800     | 50482   | 67714   | 111700                   | 282700               |
| D074           | Heliborne Missile - HELLFIRE         | 4000    | 800     | 50482   | 67714   | 111700                   | 282700               |
| Procurement:   | Funds                                |         |         |         |         | 488100                   | 488100               |
|                | Quantities                           |         |         |         |         |                          | 227                  |

BRIEF DESCRIPTION OF ELEMENT: HELLFIRE is an anti-armor terminal homing missile system which uses a shaped charge warhead to defeat individual hardpoint targets and is designed to utilize a variety of seeker modules as the guidance system. The Laser HELLFIRE will provide accurate fire on acquired targets which have been designated by: ground observers, aerial scout helicopter crew members or attack helicopter crew members. Attack helicopters will have a launch and leave capability when the target is designated by aerial/ground observers. The designator element of the system will provide the capability of designating both stationary and moving targets located at ranges beyond that of enemy air defense guns.

BASIS FOR FY 1978 RDTE REQUEST: The Engineering Development (ED) contractor will do the major portion of the designing, developing, fabrication and evaluation of the ED missiles. Component/subsystem tests and missile flight tests will be conducted. Warhead testing will be conducted, and hardware will be delivered for Advanced Attack Helicopter (AAH) testing.



Budget Activity #4 - Tactical Programs

Program Element #6.43.10.A Title Heliborne Missile - HELLFIRE

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: FY 1977 funding was constrained to a level of \$17.3M which was used primarily to fund the Engineering Development (ED) contractor. Initiation of Engineering Development is reflected by increased funding.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |                       |       |       |
|----------------------------|------|-------------|-------|-----------------------|-------|-------|
| (1) Federal Civ. Employees | 83   | 0           | 83    | (1) Estimated Govern- |       |       |
| (2) Contractor Employees   | 575  | 0           | 575   | ment Liability        | 52269 | 9378  |
|                            |      |             |       | Financed with:        |       | 61647 |
| Total                      | 658  | 0           | 658   |                       |       |       |

TERMINATION COST: (\$ in Thousands)

FY 1977  
and  
Prior

FY 1978

Total

DETAILED BACKGROUND AND DESCRIPTION: This program began with exploratory development in laser guidance. Previous work by the Army, Navy and Air Force has established the technical feasibility of using lasers to designate targets for terminal homing of laser seeker equipped ordnance. The Army conducted a successful prototype flight test program using the HORNET, an off-the-shelf missile developed for the US Air Force by North American Rockwell, in order to reduce developmental risk and to demonstrate system feasibility of a helicopter launched laser guided missile. This missile was modified with laser terminal homing capabilities. Fifty-six missiles have been fired.

Laser Seeker (ALS), All but one of these missiles were launched from a helicopter at ranges of 10 to 20 kilometers. The target was illuminated by a laser designator at ranges up to 10 kilometers. This prototype program has demonstrated a circular error probable of approximately 100 meters. The helicopter launched missile is designed to provide a very high single-shot kill probability against tanks and other armored targets at direct fire ranges up to 10 kilometers. This missile system can utilize either ground or airborne laser designation. When the target is designated by a ground designator the helicopter launches the missile and remasks immediately or takes evasive action. As currently scheduled the missile will begin entering the inventory in FY 1978 and will be mounted on the Advanced Attack Helicopter (AAH). The modular missile design will permit other types of seekers to be used as they are developed.

RELATED ACTIVITIES: These activities are related to Air Force and Navy systems which utilize similar technology. Coordination is effected through technology coordination groups, frequent liaison visits, exchange of components and subsystems, and exchange of test results. The exploratory prototype program described in the background paragraph was conducted under Program Element (P.E.) 6.23.03.A, Missile Technology. Work on an Infrared Imaging Seeker (IRIS) will be done in PF 6.33.16.A, Heliborne Homing Technology, funded in FY 1978. The Advanced Attack Helicopter is being developed under P.E. 6.42.07.A.

Budget Activity #4 - Tactical Programs

Program Element #6.43.10.A

Title Heliborne Missile - HELLFIRE

WORK PERFORMED BY: US Army Missile Research and Development Command, Huntsville, Alabama; US Army Armament Research and Development Command, Aberdeen, MD; North American Rockwell, Columbus, Ohio; and Thiokol, Huntsville, Alabama.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: Exploratory development work commenced in FY 1971. The FY 1972 program initiated concept formulation activities. The efforts also included work on fire control integration, laser measurements, countermeasure investigations, and warhead design. Flight tests were conducted with degree and degree field of view seekers to obtain information on the achievability of terminal accuracy and designator tracking accuracy. Additionally, the funding provided hardware for scheduled operational tests. The FY 1973 program provided for completion of a cost effectiveness study, and two phases of a Military Potential Test (MPT). These efforts were designed to provide a basis for a decision to enter full scale development of a laser guided missile in FY 1974. The results from the MPT and Cost and Operational Effectiveness Analysis, however, revealed some operational uncertainties that warranted further investigation. Consequently, during the 3rd Quarter of FY 1974 the decision was made to keep the laser missile program in Advanced Development (AD) for two more years. Efforts during FY 1975 included follow-on technical tests, field tests, and extensive use of simulation to resolve the operational questions. Additional firings were accomplished at the US Army Missile Research and Development Command (MIRADCOM). The field tests conducted by US Army Training and Doctrine Command (TRADOC) concentrated on determining engagement ranges, degradation of laser effectiveness by vulnerability of the designators and overall system reliability. All on-going testing was completed by June 1975. FY 1976 was a significant developmental year that represented the final stages of Advanced Development, and included preparation for both an Army Systems Acquisition Review Council (ASARC) and Defense Systems Acquisition Review Council (DSARC). A Request for Proposal (RFP) for Engineering Development (ED) was prepared and released to industry. Major developmental efforts were accomplished in six areas: (1) Warhead design and testing; (2) Definition of functional requirements for the modular missile; (3) Design studies to assess impact of increasing missile diameter from 6" to 8"; (4) Engineering evaluation on hardware received from Advanced Development contractors; (5) Simulation runs on operational contract hardware; and (6) Initiated first stages of the Coordinated Test Plan. Initial deliveries of the Air Force Tri-Service seekers took place late in FY 1976, and preparations were started for FY 1977 and FY 1978 testing. During FY 1977 the source selection of Engineering Development proposals took place, and tests on the Tri-Service laser seekers commenced.

2. FY 1977 Program: A cost and schedule baseline was established. Producibility Engineering Planning (PEP) was initiated. The designing, fabrication and procurement of the prototype AH-1G fire control system for evaluation began. The component/subsystem testing and special systems testing started, and delivery of both missiles and launchers to the Advanced Attack Helicopter (AAH) program commenced.

3. FY 1978 Planned Program: The Engineering Development (ED) contractor shall design, develop, fabricate and evaluate missiles, missile subsystems, command and launch, and peculiar support equipment for both development and tactical prototypes during FY 1978.

Budget Activity #4 - Tactical Programs

Program Element #6.43.10.A

Title Hellborne Missile - HELLFIRE

The ED contractor will continue to perform component/subsystems tests and special systems tests. The contractor will also perform missile flight tests and component qualification tests during this time frame. Flight certification of the AH-1G and missile flight test success criteria will both be met by the ED contractor. Hardware delivery will be made to meet Advanced Attack Helicopter (AAH) program requirements for safety of flight tests, helicopter development tests and weapons systems qualification tests. The Producibility Engineering Planning (PEP) effort by the ED contractor to assure the hardware and production system are ready for Low Rate Initial Production (LRIP) will continue. The ED contractor will deliver components for independent component evaluation and component qualification tests to be performed by the Government. Warhead tests will be conducted at US Army Armament Research Development Command, Aberdeen, MD. Laser seekers will be procured from the Air Force and delivered for integration on the HELLFIRE modular missile by the HELLFIRE ED contractor. Funding increase is due to initiation of Engineering Development.

4. FY 1979 Planned Program: The FY 1979 program will be a continuation of the effort started in FY 1978. The ED contractor will complete special system tests, component qualification tests and deliveries of launchers to AAH during this time frame. System qualification tests will be performed by the ED contractor. The Operational Test II (OT II) on the AH-1G helicopter will be performed during the latter part of Environmental storage tests will begin the last quarter of and will continue for two years. Hardware procurement requires increase funding.

5. Program to Completion: Contractor efforts will continue with Operational Testing II (OT II) starting on the prototype AH-1G in late followed by installation on the AAH for OT II. Low Rate Initial Production will begin about December 1980 with Initial Operational Capability (IOC) scheduled for

6. Major Milestones:

- a. ASARC II
- b. DSARC II
- c. ED Contract Award
- d. OT II Start (COBRA)
- e. ASARC/DSARC III
- f. Low Rate Initial Production
- g. ASARC/DSARC IIIa
- h. Initial Operational Capability (AAH)

Estimated RDTE Cost to  
Reach Events (Cumulative)  
(\$ in Thousands)

| Date   |        |
|--------|--------|
| Jan 76 | 39000  |
| Feb 76 | 39000  |
| Oct 76 | 40000  |
|        | 182000 |
|        | 212000 |
|        | 222000 |
|        | 266000 |
|        | 282700 |

Budget Activity #4 - Tactical Programs

Program Element #6.43.10.A

Title Heliborne Missile - HELLFIRE

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: Rockwell International was selected as the engineering development contractor in October 1976. Prior to this, off-the-shelf missile (HORNETS), modified by the US Army Missile Research and Development Command to accept a laser guidance device, were successfully flight tested. Fifty-six missiles were fired. All but one of these missiles were launched from a helicopter at ranges of 10 to 20 miles. The target was illuminated by a laser designator at ranges of 10 to 20 miles. This prototype program has demonstrated a circular error probable of approximately 100 feet. All testing completed during the past three years has been pointed at resolution of operational uncertainties. These tests and other testing efforts are outlined below:

a. Technical tests (live firings) were conducted at the US Army Missile Research and Development Command to demonstrate the technical feasibility of the following modes of operations of HELLFIRE Laser Only (HFLLO):

- (1) Ripple Fire - Demonstrated that two missiles can be fired from the same helicopter against two targets being designated by two designators using two Ground Laser Locator Designators (GLLDs) or using a GLLD and an Airborne Laser Locator Designator (ALLD) operating on different codes.
- (2) Rapid Fire - Demonstrated that two or more missiles can be fired from the same helicopter against more than one target being designated successfully by the same designator using the same code.
- (3) Night Firing - The night firing completed on 24 April 1974 demonstrated that an observer using a GLLD equipped with a night sight can locate and designate targets out to ranges of 10 to 20 miles for engagement by an attack helicopter (AH) using laser terminal homing missiles. The missile scored a direct hit.
- (4) Scout/ALLD AH Firing - Demonstrated the hunter-killer concept by designating from a helicopter equipped with an ALLD and firing from an attack helicopter.
- (5) Self-Contained Firing - Demonstrated the self-contained designation mode of operation by firing from a helicopter equipped with an ALLD.
- (6) Indirect Air Launch - Demonstrated the capability for indirect launch against stationary and moving tank targets using the field-of-view Army Laser Seeker.



Budget Activity #4 - Tactical Programs

Program Element #6.43.10.A

Title Heliborne Missile - HELLFIRE

b. The results from a pre-advanced development program, the Terminal Homing Accuracy Demonstration (THAD) program, combined with the results of the technical tests, fulfilled the requirement for Development Test (DT) I. Further development testing during the Advanced Development (AD) contract evaluated and refined component, subsystem and system design to support the Engineering Development (ED) decision. Countermeasure/Counter-countermeasure (CM/CCM) testing of the Army laser seeker was conducted by the Test Director, Joint Services Laser Guided Weapons Countermeasures Test Program. Test results indicated adequate technical development of the laser seeker, however, susceptibility to [redacted] indicated a requirement for further operational testing.

c. Development Test (DT) II will be conducted [redacted] with ED hardware to assess capabilities of the HELLFIRE System. This test in conjunction with engineering design tests will provide necessary technical data for assessment of system readiness for Low Rate Initial Production.

d. Production Validation tests in [redacted] will assess hardware from an initial production run to verify that prescribed specifications have been met and deficiencies found in DT II and Operational Test (OT) II have been corrected.

2. Operational Test and Evaluation:

a. Operational Test (OT) I was not conducted or scheduled. US Army Training and Doctrine Command (TRADOC) field experiment, Laser Guided Missile System (LAGMS) was proposed as OT I. LAGMS did not test HELLFIRE per se, but it did demonstrate the operational feasibility of HELLFIRE. This, together with low technical risk demonstrated by US Army Missile Research and Development Command (MIRADCOM) testing, led to the decision by the Army Systems Acquisition Review Council (ASARC) that obviated the need for an OT I. The Vice Chief of Staff, Army (VCSA) made the decision on 30 January 1974 to keep HELLFIRE in advanced development and conduct additional testing to resolve operational uncertainties associated with the employment of the Laser Only HELLFIRE missile system. TRADOC completed field testing in July 1975 of the Laser Only HELLFIRE to include the modes of ripple, rapid, and indirect fire and results were incorporated into the Cost and Operational Effectiveness Analysis (COEA). This analysis indicated a substantial advantage of HELLFIRE over TOW on the Advanced Attack Helicopter (AAH).

b. OT II is scheduled during [redacted] at Yuma Proving Grounds, AZ. The Operational Test and Evaluation Agency (OTEA) will conduct this test using flight crews and maintenance personnel provided by Forces Command (FORSCOM). The test will be conducted in two parts - a nonfire field exercise and a live fire exercise. OTEA will provide an independent evaluation to the appropriate decision review.

c. OT III is scheduled in [redacted]



Budget Activity #4 - Tactical Programs

Program Element #6.43.10.A

3. Systems Characteristics:

Weight (total)  
Warhead Weight  
Range  
Maneuverability  
Diameter  
Length  
Time of Flight  
Time of Flight

Objective \*

75-95 lbs.

Demonstrated \*\*

Title Heliborne Missile - HELLFIRE

\* As specified in 30 September 1976 System Acquisition Report.

\*\* Data will be reflected when available.

# FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.01.A  
 Category Engineering Development  
 Title Infantry Support Weapons  
 Budget Activity #4 - Tactical Programs

## RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 3270    | 650     | 629     | 9509    | 1207                     | 22175                |
| D029           | Lightweight Company Mortar System    | 3270    | 650     | 629     | 2809    | 1207                     | 15475                |
| D227           | Battalion Mortar System              | 0       | 0       | 0       | 6700    |                          | 6700                 |

BRIEF DESCRIPTION OF ELEMENT: In past years this program element (PE) supported infantry-related development in flame weapons, Vehicle Rapid Fire Weapon Systems (VRFWS), BUSHMASTER, and pyrotechnics - all of which were transitioned into other program elements. The program element now supports the development of companion rounds of 60mm mortar ammunition for the lightweight company mortar system. In FY 1979 this element will support the testing and value engineering of the United Kingdom (UK) L16A2, 81mm mortar for employment by the US Army. Potential domestic production of the L16A2 is an integral part of the program.

BASIS FOR FY 1978 RDTE REQUEST: Procure 2250 60mm illuminating cartridges and conduct ballistic firing tests.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: FY 1977 funds completed development of the basic weapon high explosive (HE) round of ammunition. FY 1978 funds initiate the development of a companion illumination round for the mortar system.

## PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                           | RDTE | PROCUREMENT | TOTAL |
|---------------------------|------|-------------|-------|
| (1) Federal Civ Employees | 13   | 0           | 13    |
| (2) Contractor Employees  | 5    | 0           | 5     |
| Total                     | 18   | 0           | 18    |

788

**Budget Activity #4 - Tactical Programs**

Program Element #6.46.01.A

Title **Infantry Support Weapons**

**DETAILED BACKGROUND AND DESCRIPTION:** The Lightweight Company Mortar System (LWCMS) consists of an improved 60mm mortar, conventional-style fire control and high explosive ammunition fuze with a new multi-option electronic fuze. Illuminating and white phosphorus ammunition will also be developed. The LWCMS will fulfill the requirement to provide a fire support system at the company level which is really man-portable. The 47 lb mortar and 3.75 lb round of ammunition weigh less than half the present 96 lb, 81mm mortar and 9 lb round of ammunition. Nevertheless, lethality effectiveness of the LWCMS equals 70% that of the 81mm mortar per round of ammunition fired. The mortar can be fired out to 1000 meters using a small baseplate and no bipod, or out to 3500 meters using the standard baseplate and bipod. The LWCMS will replace the 81mm mortar at company level in all infantry organizations except mechanized infantry. The ammunition for the lightweight mortar includes the 60mm illuminating round and the smoke (white phosphorus) round. The illuminating round will fire to a range sufficient to illuminate targets being engaged with the high explosive (HE) cartridge at maximum range (3500 meters). The smoke round for the lightweight mortar will match ballistically the HE round to its maximum range. The new 81mm mortar will fire newly developed ammunition, employing the new multi-option fuze, to a range of 5500 meters. The United Kingdom (UK) L16A2, 81mm mortar, already developed and fielded for UK forces, is the weapon system which upon successful completion of a detailed evaluation against US Army requirements, will be engineered for US production and use.

**RELATED ACTIVITIES:** This development will also satisfy the US Marine Corps requirements for mortar ammunition. Full coordination of this development with the Marine Corps continues. Program Element (PE) 6.36.08.A, Weapons and Ammunition, LWCMS, supported advanced development of the LWCMS except for the multi-option fuze. PE 6.36.13.A, Advanced Fuze Design, supported the advanced development of the multi-option fuze, XM734. PE 6.46.02.A, Field Artillery Ammunition, supported engineering development of the fuze initially until it was transferred to this PE in FY 74. PE 6.36.13.A, Advanced Fuze Design, supported the advanced development of a electronic time fuze for one year in FY 76 in order to demonstrate that technology is in hand to provide an electronic time fuze for the LWCMS illuminating round. The UK L16A2 evaluation has undergone feasibility testing under PE 6.57.09.A, Evaluation of Foreign Component.

**WORK PERFORMED BY:** In-house efforts are accomplished by US Army Armaments Research and Development Command, Dover, NJ; and US Army Test and Evaluation Command, Aberdeen, MD. Major contractors are: Eastman Kodak, Rochester, NY; Bergman Manufacturing, Garland, TX; IITRI, Chicago, IL; Ruoff, Inc, Runnemed, NJ; and Norris Industries, Los Angeles, CA.

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. FY 1977, FY 1976, and Prior Accomplishments: The basic lightweight company mortar system, HE round of ammunition and revolutionary new multi-option fuze were fully developed and type-classified standard. This system will first be procured in FY 1978.

Budget Activity #4 - Tactical Programs

Program Element #6.46.01.A

Title Infantry Support Weapons

2. FY 1977 Program: Minor engineering deficiencies, revealed by testing, will be corrected. Additional Producibility, Engineering and Planning (PEP) on the multi-option fuze is being conducted to lower procurement costs.
3. FY 1978 Planned Program: Engineering Development of the 60mm illuminating round, to include procurement of 2500 rounds of illuminating ammunition for developmental testing, and conduct of ballistic firing tests, will be initiated.
4. FY 1979 Planned Program: Dependent on recommendations of the FY 1977 US Army Test and Evaluation Command (TECOM) evaluation, the program will support procurement of 12 United Kingdom (UK) prototypes and ammunition for testing; the planning, conduct, evaluation; and analysis of Developmental Test II (DT II/OT II); PEP; development of a technical data package for production; type classification action; and administrative support. The 60mm illuminating round of ammunition will undergo DT II/OT II for type-classification standard.
5. Program to Completion: Engineering development on the 60mm smoke (white phosphorus) round of ammunition to include hardware procurement for testing and initial DT II subtests will be initiated. The 60mm smoke round will enter DT II/OT II, and all necessary action to bring this round of ammunition to type-classification and production will be conducted.

6. Major Milestones:

|   | Date   | Estimated RDTE Cost to<br>Reach Events (Cumulative)<br>(\$ in Thousands) |
|---|--------|--|
| a. Type classify Lightweight Company Mortar     | 20FY77 | 10500  |
| b. Type classify Illuminating Round             | 10FY79 | 14600  |
| c. Type classify Battalion Mortar, 81mm         | 40FY79 | 20000  |
| d. Type classify Smoke (White Phosphorus) Round | 20FY80 | 22175  |

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.46.01.A

Title Infantry Support Weapons

Project #D227

Title Battalion Mortar System

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The current standard mortar at Battalion level is the 4.2 inch mortar. The 4.2 inch mortar, developed in the early 1940s for World War II, has reached obsolescence and has no potential for improvement. The Army has decided to replace this mortar with a new 81mm mortar and ammunition. The new 81mm mortar will fire new ammunition, employing the new multi-option fuze, to ranges of 5500 meters. The United Kingdom (UK) L16A2 81mm mortar, already developed and fielded for UK forces, is the weapon system which, upon successful completion of a detailed evaluation against Army requirements, will be engineered for US production and use.

RELATED ACTIVITIES: The UK L16A2 mortar is being evaluated under Program Element 6.57.09.A, Evaluation of Foreign Components.

WORK PERFORMED BY: Program responsibility, US Army Armament Research and Development Command, Dover, NJ, and Watervliet, NY; US Army Test and Evaluation Command, Aberdeen, MD. Commercial contractors to support this development have not been determined.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Not Applicable.
2. FY 1977 Program: Not Applicable.
3. FY 1978 Planned Program: Not Applicable.
4. FY 1979 Planned Program: This development is a new start in FY 1979. Dependent on recommendations of the FY 1977 US Army Test and Evaluation Command (TECOM) evaluation, the program will support procurement of 12 prototypes for testing; the planning, conduct, evaluation and analysis of Development Test II (DT II/OT II); producibility engineering and planning (PEP); development of a technical data package for production; type classification action; and administrative support.
5. Program to Completion: Not Applicable.



Budget Activity #4 - Tactical Programs

Program Element #6.46.01.A

Project #D227

6. Major Milestones:

Title Infantry Support Weapons

Title Battalion Mortar System

Estimated RDTE Cost to  
Reach Events (Cumulative)

6500

6700

Date

Apr-Jun 79

Sep 79

a. Development Test/Operational Test II

b. Type Classification

RESOURCES: (\$ in Thousands)

RDTE:

Funds  
Quantities

|  | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional<br/>to<br/>Completion</u> | <u>Total</u> |
|--|----------------|----------------|----------------|----------------|---|--------------|
|  | 0              | 0              | 0              | 6700           | Not Applicable                          | 6700<br>14   |

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.46.02.A

Title Weapons and Ammunition

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number                           | Title  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|--|--|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|  | TOTAL FOR PROGRAM ELEMENT  | 6903    | 1118    | 2089    | 3537    |                                     |                                     |
|  | Quantities (Not feasible to list due to number of diverse items) |         |         |         |         |                                     |                                     |
| DG21                                     | Tank Ammunition  | 2023    | 0       | 0       | 0       | 0                                   | Not Applicable                      |
| D169                                     | Field Artillery Fuze Development                                 | 0       | 0       | 114     | 3337    | Continuing                          | Not Applicable                      |
| D454                                     | Fuze, XM587  | 4790    | 1118    | 1975    | 200     | 0                                   | Not Applicable                      |
| D679                                     | Cartridge 40mm   | 90      | 0       | 0       | 0       | 0                                   | Not Applicable                      |
| Procurement: 105mm Tank Cartridge (M735) |  |         |         |         |         |                                     |                                     |
|  | Funds  |         | 63500   | 63000   | 50800   | 105200                              | 282500                              |
|  | Quantities   |         | 107     | 124     | 108     | 216                                 | 555                                 |
| 40mm Cartridge (XM781)                   |  |         |         |         |         |                                     |                                     |
|  | Funds  |         |         |         |         |                                     |                                     |
|  | Quantities   |         |         |         |         |                                     |                                     |

No planned buys for the new practice cartridge until FY 1982, due to present stockpile quantities.

BRIEF DESCRIPTION OF ELEMENT: This program element has been restructured to focus on full-scale development of fuzes for increased lethality, accuracy, range, reliability, and responsiveness of weapons systems.

BASIS FOR FY 1978 RDT&E REQUEST: To provide for continued full-scale development of 3 electronic time fuzes: one each for use on all high explosive and multiple warhead (bomblet) artillery projectiles, and one for beehive ammunition (which releases nail-like submissiles).

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The artillery electronic time fuzes must be fabricated for final developmental tests. Project D169 Field Artillery Fuze Development is a continuation of Project D028 Field Artillery Ammunition, which was terminated in FY 1976.

Budget Activity #4 - Tactical Programs

Program Element #6.46.02.A Title Weapons and Ammunition

PERSONNEL IMPACT:

The average number of employees support with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 134         | 0                  | 134          |
| (2) Contractor Employees   | 47          | 920                | 967          |
| TOTAL                      | 181         | 920                | 1101         |

DETAILED BACKGROUND AND DESCRIPTION: This program originally encompassed a full spectrum of projects for artillery and tank ammunition and weapons, including fuzes. The program was subsequently restructured to place non-fuzing developments in other program elements. The development of improved fuzes is necessary to complement improvements in weapons and ammunition. The present program includes two active projects for improved fuzing. The objective of Project D454 Fuze, XM587 is to develop a pair of highly accurate and reliable electronic time fuzes for use on all high explosive and multiple warhead (bomblet) artillery rounds. An advanced electronic time fuze for beehive rounds, developed under Project D169 Field Artillery Fuze Development, will be more producible and cost approximately half as much as the mechanical fuze it replaces.

RELATED ACTIVITIES: This program is the full-scale development follow-on to work initiated in Program Element 6.36.13.A, on Advanced Fuze Design, and is dependent on technology developed under Program Element 6.26.16.A, on Fuze Technology. There are no known competing systems within the Tri-Services.

WORK PERFORMED BY: In-house agencies include Harry Diamond Laboratories, Adelphi, MD ; US Army Armament Research and Development Command (ARRADCOM) Dover, NJ and Rock Island IL ; US Army Test and Evaluation Command, Aberdeen, MD; Yuma Proving Ground, Yuma, AZ. Contractors include: Honeywell, Minneapolis, MN; Motorola, Incorporated, Scottsdale, AZ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The program element in these years included the development of artillery and tank weapons, projectiles, and fuzes. Developments successfully completed include a 155mm multiple warhead (bomblet) round and rocket-assisted high explosive round, and a mechanical time artillery fuze. The developments of electronic time fuzes and a proximity fuze for artillery were initiated. Development of an improved artillery proximity fuze (for air bursts of high

Budget Activity #4 - Tactical Programs

Program Element #6.46.02.A Title Weapons and Ammunition

explosive rounds) was completed. This more reliable and less costly fuze will replace all artillery proximity fuzes in stockpile. The artillery electronic time fuzes achieved high reliability scores in field tests. Full-scale development of an electronic time fuze for beehive ammunition was initiated. Development Test II testing of the improved 105mm XM735 tank gun projectile was conducted with satisfactory results and the XM735 Cartridge was type classified as standard (STD).

2. FY 1977 Program: Formal full-scale development tests of the artillery electronic time fuzes will begin.

3. FY 1978 Planned Program: Artillery electronic time fuzes will be fabricated for final developmental testing. Engineering and planning for production will be done. The development of electronic time fuzes for beehive ammunition will be reinstated as Project D169 Field Artillery Fuze Development, with fabrication and testing of the fuzes. Funding increase due to procurement and testing of electronic time fuzes for artillery systems 105mm through 8 inch.

4. FY 1979 Planned Program: Production plans and development of the artillery electronic time fuzes will be completed. Fabrication and testing of prototype beehive electronic time fuze will continue. Funding increase due to procurement and testing of fuzes for BEEHIVE AMMUNITION.

5. Program to Completion: This is a continuing program.

6. Major Milestones:

Type Classification Standard.

|                       | Date       |
|-----------------------|------------|
| a. M735 Cartridge     | FY 1977    |
| b. BEEHIVE Fuze XM742 | 2Q FY 1982 |
| c. Fuze XM587         | 1Q FY 1979 |
| d. Cartridge          | 3Q FY 1977 |

FY 1978 RDT&E DESCRIPTIVE SUMMARY

|   |   |
|---|---|
| Program Element #6.46.02.A              | Title <u>Weapons and Ammunition</u>           |
| Project #D169                           | Title <u>Field Artillery Fuze Development</u> |
| Category <u>Engineering Development</u> | Budget Activity #4 - Tactical Programs        |

DETAILED BACKGROUND AND DESCRIPTION: Man-portable anti-armor weapons pose a significant threat to our tanks and other armored vehicles. Attacks by these weapons can be suppressed by beehive ammunition, which releases nail-like anti-personnel submissiles. This project will develop an electronic time fuze for precise release of the beehive submissiles at a preset range. The electronic fuze will be a direct replacement for an existing mechanical fuze costing twice as much. The existing fuze has had a history of producibility problems, one of which is the decreasing mechanical clock production base. The electronic fuze benefits from the rapidly growing electronic timer (watches, etc.) industry.

RELATED ACTIVITIES: This project is a new start in FY 1978. It is a continuation of work started in Project D028 title ammunition cannon, 105mm. This full-scale development is a follow-on to work initiated in Program Element 6.36.13.A, Advanced Fuze Design, and is dependent on technology developed under Program Element 6.26.16.A, Fuze Technology.

WORK PERFORMED BY: In-house agencies include USA Armament Research & Development Command (ARRADCOM), Dover, NJ, Rock Island, IL (or successor agencies); US Army Test and Evaluation Command, Aberdeen, MD; Yuma Proving Ground, Yuma, AZ. Contractors include Motorola, Incorporated, Scottsdale, AZ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: N/A
2. FY 1977 Program: N/A
3. FY 1978 Planned Program: Engineering prototype fuzes will be fabricated. An analysis of failure modes will be made, including a stress analysis of critical parts. Design efforts will concentrate on reliability and producibility improvements. All necessary experimental work has been performed and the proposed system is ready for full scale development.
4. FY 1979 Planned Program: A contract will be awarded to fabricate a second iteration of fuzes. These units will undergo environmental and ballistic tests. The objective for this year will be to reduce cost and risk to a minimum prior to building fuzes for final developmental acceptance justify increase in funds. Increase in funding attributable to procurement & testing of quantities of fuzes for development testing.



Budget Activity #4 - Tactical Programs

Program Element #5.46.02.A

Project #2169

Title Weapons and Ammunition

Title Field Artillery Fuze Development

Program to Completion: This is a continuing project.

Major Milestones: Type classification standard FY 1982.

REMARKS: (\$ in Thousands)

| NOTE: Funds | FY 1976 | FY 1977 | FY 1977 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|-------------|---------|---------|---------|---------|---------|---------|--------------------------------|----------------------------|
|             |         |         |         |         |         |         |                                |                            |
| Quantities  | 0       | 0       | 0       | 0       | 114     | 3337    | Continuing                     | Not Applicable             |

(Fabrication of units for formal testing begins in FY 1980)

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.46.03.A

Title Nuclear Munitions

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/ (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT       | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion<br>Continuing | Total<br>Estimated<br>Cost<br>Not Applicable |
|----------------|--|---------|---------|---------|---------|--|--|
| D080           | Tactical Earth Penetrator Warhead (TEPW) |         |         |         |         |  |  |
| D205           | LANCE Adaption Kit                       |         |         |         |         |  |  |
| D385           | Improved 155mm Projectiles               |         |         |         |         |  |  |
| D388           | M422 Projectile Modification             |         |         |         |         |  |  |
| D663           | Improved 8-Inch Nuclear Projectile       |         |         |         |         |  |  |
| Procurement:   |  |         |         |         |         |  |  |
| Funds          |  |         |         |         |         |  |  |
| Quantities*    |  |         |         |         |         |  |  |

\* Not feasible to list.

BRIEF DESCRIPTION OF ELEMENT: This PE is the foundation of the Tactical Nuclear Munitions Modernization Program. Included are programs to improve and modernize Artillery Fired Atomic Projectiles (AFAP), both 155mm and 8-inch, the LANCE warhead section, and earth penetrator developments. The 8-inch nuclear projectile, XM753, project number D663, is the keystone of the modernization

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A Title Nuclear Munitions

program. An in-process production change is underway to significantly improve the effectiveness and security of the LANCE warhead. Upon receiving full Congressional approval, work on a replacement for the 155mm nuclear round will begin.

BASIS FOR FY 1978 RDTE REQUEST: For the XM753, 8-inch nuclear projectile, testing and Joint Army/Energy Research and Development Administration (ERDA) testing will continue. For the XM785, the replacement 155mm nuclear projectile, engineering development of the fuze, the projectile body, and the adaptation kit will be accomplished. Joint Army-ERDA testing will begin. For LANCE, testing of the adaptation kit for the MOD 3 warhead will be completed, with

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Reflects the RDTE funding of the in-process production change for the LANCE missile, a slight cost growth due to increased testing and some revised requirements for the 8-inch nuclear projectile (XM753), and the beginning of joint ERDA-Army engineering development for the new 155mm nuclear projectile.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 91          | 0                  | 91           |
| (2) Contractor Employees   | 61          | 0                  | 61           |
| Total                      | 152         | 0                  | 152          |

DETAILED BACKGROUND AND DESCRIPTION: The objective is development of a new 8-inch nuclear projectile (XM753), a new 155mm nuclear projectile (XM785) after receiving explicit Congressional approval, and an in-process production change to the LANCE warhead. Each program permits a significantly improved military effectiveness with greatly reduced collateral damage. Advances in technology now permit weaponization of a completely new type of warhead that maximizes effectiveness against

to preclude damage to the civilian populace.

The XM753 replaces the M422 projectile which uses significant limitations. The XM785 will replace the M454 projectile, which has a

For LANCE, the change to the MOD 3 configuration capitalizes on recent technological advances and provides for entry into the total stockpile of weapons with

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A

Title Nuclear Munitions

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments:

- a. XM753. 8-inch nuclear projectile. Design of all Army components has been completed and major testing accomplished. Energy Research and Development Administration (ERDA) laboratories have completed structural and functional firings of advanced warheads. The Nuclear Weapon System Safety Committee (NWSSC) has verified the safety of the total design to date. Ballistic similitude with the XM650 high explosive projectile has been verified.
- b. XM785. 155mm nuclear projectile. The Phase 2 feasibility study was completed and identified feasible designs of military significance. Other than supporting studies, and capitalizing on effort done under the XM753 program, no additional effort has been completed.
- c. LANCE Adaption Kit. Limited redesign of the adaption kit to support the in-process production change to the improved version MOD 3. All studies detailing the interface with ERDA have been completed.

2. FY 1977 Program:

- a. XM753. Design release of ERDA Components for initial prototype production will be completed. Test firings continue. Procurement funding release for low rate initial production (LRIP) for fuze and for projectile training and handling equipment.
- b. XM785. No effort will be accomplished. Congress prohibited any such effort in FY 77 and required the Army with ERDA to justify the requirement for a new 155mm projectile. Rejustification planned 2-3QFY77.
- c. LANCE. Completion of minor changes to the adaption kit and associated components to accommodate the MOD 3 warhead. Completion of most of the testing, both laboratory and in the field. Complete NWSSC review of the program.
- d. Tactical Earth Penetrator Warhead (TEPW). No effort on TEPW in the PE in FY 1977. The Army's TEPW efforts are being accomplished under PE 6.33.11.A, PERSHING II. These funds will be reprogrammed to Project D135 in PE. 6.36.04, Nuclear Munitions and Radiacs, to provide RTE support for the Army-wide missions of the recently established Project Manager for nuclear munitions.

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A

Title Nuclear Munitions

3. FY 1978 Planned Program:

- a. Tactical Earth Penetrator Warhead (TEPW). No plans. TEPW efforts will continue under the PERSHING II program, supported by some limited feasibility and system studies in PE 6.26.03.A, Large Caliber and Nuclear Technology, Project AH 18.
- b. LANCE Adaption Kit.  
with Energy Research and Development Administration (ERDA) with  
The is coordinated
- c. Improved 155mm Projectile. This is a new start this fiscal year. Begin engineering development on the fuze, projectile body and associated ancillary equipment. Conduct appropriate Army-ERDA testing. ERDA will conduct
- d. Improve 8-Inch Projectile.  
established through testing, Low Rate Initial Production of the remaining war reserve items will continue. Fuze safety will be

4. FY 1979 Planned Program: Engineering development will continue on the 155mm nuclear round. The 8-Inch round will

5. Program to Completion: The 8-Inch program will be completed leading to  
to be followed by the 155mm nuclear projectile, leading to  
Major milestones and cumulative costs are in Project  
Nuclear D663, Improved 8-Inch Nuclear Projectile, and D385, Improved 155mm Projectile, for the two nuclear projectiles. The  
program for Earth Penetrator has not been defined at this time.

6. Major Milestones:

- a. LANCE MOD 3 Warhead
- b. XM753 8-Inch Nuclear Round
- c. XM785 155mm Nuclear Round
- d. Tac Earth Penetrator

Estimated RITE Cost to  
Reach Events (Cumulative)

Date



FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.46.03.A

Project #D080

Category Engineering Development

Title Nuclear Munitions

Title Tactical Earth Penetrator Warhead

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: This project supports the engineering development of Tactical Earth Penetrator Warheads (TEPW) for artillery and missile systems delivery. TEP WHDs offer the same type of cratering capability as Atomic Demolition Munitions (ADM) with the added advantage of stand-off emplacement capability. This capability has become possible through the recently developed high accuracy guidance system technology.

RELATED ACTIVITIES: This project is related to PE 6.36.04.A, Nuclear Munitions and Radiacs, and PE 6.33.11.A, Pershing II, advanced technology in which advanced development of TEPW is conducted.

WORK PERFORMED BY: US Army Armament Research and Development Command, Dover, NJ; Sandia Laboratories, Albuquerque, NM.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: None. This is a new project.
2. FY 1977 Program: No funds allocated.
3. FY 1978 Planned Program: None planned.
4. FY 1979 Planned Program:

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A

Project #D080

Title Nuclear Munitions

Title Tactical Earth Penetrator Warhead

5. Program to Completion: This program is a new start for FY 1979, and therefore is not yet so sufficiently defined to permit statements concerning program completion.

RESOURCES: (\$ in Thousands)

|             | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional<br/>to<br/>Completion</u> | <u>Total<br/>Estimated<br/>Cost</u> |
|-------------|----------------|----------------|----------------|----------------|---|-------------------------------------|
| RDTE: Funds | 0              | 0              | 0              | [ ]            | [ ]                                     | Not Applicable Not Applicable       |

PT 1978 RITE DESCRIPTIVE SUMMARY

Program Element #6.46.03.A

Title Nuclear Munitions

Project #D385

Title Improved 155mm Nuclear Projectile

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is development of a new 155mm nuclear projectile, the XM785, to replace the current M454 nuclear projectile which is particularly important for NATO because of their

and the high cost of adding to their force structure. With a new 155mm projectile in addition to the 8-inch nuclear projectile, survivability of the allied tactical nuclear force will be assured and enemy targeting vastly complicated because there are some 155mm howitzers planned for Allied Forces Central Europe. Nuclear artillery is the most flexible, survivable (through mobility, cover, and concealment) and responsive tactical system. The nuclear capability is an operational bonus because it requires no change in force structure of weapons, communications equipment, and manpower spaces that the artillery needs to conduct conventional fire missions. The XM785 can be fired to in the new US and NATO howitzers. It will take advantage of technology developed in the 8-inch nuclear projectile program in the areas of state-of-the-art technology in large scale circuit integration will be used and ballistic similitude to conventional ammunition. Security will be enhanced by use of to reduce component size for packaging in the smaller projectile volume.

The new projectile

will produce about of the weapon. The new XM785 will have a' which the increase in military effectiveness against armored formations. At the same time improved accuracy and will permit effective employment in the environment with targeting constraints designed to limit civilian damage and casualties. The M454 which began production in In addition, the M454 has an by today's standards,

RELATED ACTIVITIES: The Energy Research and Development Administration (ERDA) will develop the nuclear warhead. A joint ERDA/ODD project officers group will coordinate the integrated ERDA/Army development effort. A related development is PE 6.46.14.A, Field

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A

Title Nuclear Munitions

Project #D385

Title Improved 155mm Nuclear Projectile

Artillery Weapons and Ammunition, 155 mm which includes development of the XM98 howitzer and 155mm conventional projectiles and propellant charges. In addition, England, Germany, and Italy have completed development and production is now beginning on a new 155mm howitzer, the FH70, which will be comparable with the new nuclear projectile.

WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; Harry Diamond Laboratories, Washington, DC; Army Materiel and Mechanics Research Center, Watertown, MA; ARRADCOM, Aberdeen, MD; Teerip Research and Development Administration (ERDA) Agencies, either Lawrence Livermore Laboratory, Livermore, CA or Los Alamos Scientific Laboratory, Los Alamos, NM and the Sandia Laboratories either in Livermore, CA or Albuquerque, NM.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. PY 1977, PY 1976, and Prior Accomplishments: Subsequent to the Public Works Subcommittee hearings on the PY 77 ERDA Appropriation, the ERDA and the Department of Defense were directed to jointly reassess the 155mm nuclear projectile requirement in light of the approved 8-inch nuclear projectile and the LANCE mod 3 warhead production. This report is to be provided prior to initiation of joint ERDA/Army phase 3 Engineering Development.

2. PY 1977 Program: Funds for advanced development work in PE 6.36.04, 6443, Nuclear Projectiles were zeroed by the Congress.

3. PY 1978 Planned Program: This program will be a new start in PY 1978. Work done on the fuze for the XM753 8-inch nuclear projectile components will form the basis to begin advanced development for the XM785 fuze. The development will emphasize application of Large Scale Integrated Circuit technology to reduce the size of the 8-inch fuze components for use in the 155mm projectile. Because the will transition from

metallurgical work on the effort. ERDA will conduct system is ready for full scale development.

Other areas to be emphasized include and integration of the Army effort with the ERDA warhead development hosts. All necessary experimental work has been performed and the proposed

4. PY 1979 Planned Program: This is the first full year of

engineering development fuze models and ERDA warhead components to prove structural integrity in the high g cannon environment. ERDA will continue

Funding increase is based on experience gained with the XM753, 8-inch nuclear projectile and is representative of a normal nuclear warhead development program.

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A

Project #D385

Title Nuclear Munitions

Title Improved 155mm Nuclear Projectile

5. Program to Completion: Engineering development will continue to permit begin in late leading to Initial Operational Capability in testing to

6. Major Milestones:

- a. Joint Energy Research and Development Administration Agencies/Department of Defense Development
- b. Validation In-Process Review
- c. Development Testing/Operational Testing
- d. Development Acceptance In-Process Review
- e. Initial Delivery of War Reserve Projectiles

RESOURCES: (\$ in Thousands)

|                                | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|--------------------------------|---------|---------|---------|---------|--------------------------|----------------------|
| RDTE: Funds Quantities*        | 0       | 0       | 0       | 0       | 0                        | 0                    |
| Procurement: Funds Quantities* | 0       | 0       | 0       | 0       | 0                        | 0                    |

\* Not feasible to list



FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.46.03.A

Title Nuclear Munitions

Project #D663

Title Improved 8-Inch Nuclear Projectile

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is development of a new 8-inch nuclear projectile, the XM753, providing greatly increased and responsive combat power to stop numerically superior Warsaw Pact combat formations while greatly reducing the danger to our own forces and civilians. Advances in technology now permit weaponization of a completely

but which have reduced collateral damage areas which may be to preclude damage to the civilian populace. The W79 design including a range, accurate fuze, and response after nuclear release, provides about a 50% increase in combat effectiveness over the current stockpile projectile, M422. The area exposed to collateral damage is reduced by about 80% from the M442. Protection of friendly troops and civilians is enhanced with the accuracy provided by making the XM753 ballistically similar to the XM650 high explosive projectile and by inherent fallout preclusion of the fuze. The W79 has a built-in

A built-in system prevents container permits total and immediate warhead

nuclear options highly responsive to the National Command Authority. The XM753 replaces the M422 projectile which uses

out that are ten times optimum burst altitude; a special and range

These factors also contribute to a requirement to attack targets with greater than

RELATED ACTIVITIES: The division of responsibilities between the Energy Research and Development Administration (ERDA) formerly the Atomic Energy Commission and the Department of Defense are in accordance with the Joint AEC/DOE Agreement for the Development, Production, and Standardization of Atomic Weapons, dated 21 March 1953. A joint ERDA/DOE Project Officers Group with representatives from ERDA, Army, Navy, and Marine Corps has been established for coordination of the development effort. Related Developmental projects are: P.E. 6.46.27.A, Project Number D389, 8-Inch Howitzer Self-Propelled, M110P2.

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A

Title Nuclear Munitions

Project #D663

Title Improved 8-Inch Nuclear Projectile

WORK PERFORMED BY: US Army Armament Research and Development Command (AARADCOM), Dover, NJ; Harry Diamond Laboratories, Washington, DC; Army Materiel and Mechanics Research Center, Watertown, MA; AARADCOM, Aberdeen, MD; Energy Research and Development Administration (ERDA) Agencies: Lawrence Livermore Laboratory and Sandia Laboratories Livermore, Livermore, CA; Sandia Laboratories Albuquerque, Albuquerque, NM; Motorola, Scottsdale, AZ; Ferrulematic Inc., Paterson, NJ; Norris Industries, Los Angeles, CA; Teledyne, Palo Alto, CA; Union Carbide, Bennington, VT; Container Research Corp., Glen Riddle, PA; Huber Mfg. Co., Conaga Park, CA; NCR, Mansburg, OH; and Ball Bros., Denver, CO.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: In FY 1974, Army studies confirmed the need for tactical nuclear weapons and specifically the need for dual capable conventional/nuclear cannon artillery. In addition, an ERDA/DOD feasibility study indicated that new nuclear technology was available to permit weaponization of a warhead tailored to maximize battlefield effectiveness while reducing the area of undesired collateral damage. Projectile design was based on an 8-inch high explosive rocket assisted projectile, the XM650, which had completed over 1000 successful firings. Preliminary design and testing of Army fuzing, safing, and arming systems, based on developments for earlier nuclear projectile programs, were completed. Warhead feasibility was confirmed by successful underground nuclear testing in April 1974. Cost effectiveness analyses, and technical documentation necessary for program initiation were completed and forwarded to DOD in May 1974. In July 1974, the DOD directed development of a new 8-inch nuclear projectile, the XM753. Division of development and funding responsibilities between the ERDA and the Army was based on an agreement signed in September 1974. In FY 1975 initial models of the Army fuze were tested. The ERDA conducted successful underground nuclear tests in April 1975 of a weaponized warhead and in June 1975 to confirm warhead nuclear safety inside a gun barrel. Design of all Army components was completed in Thirty-eight recovered fuzes to establish, design and performance of the telemetry systems, fuze/firing table test projectiles, and aeroballistic evaluation projectiles. Additional gun firings established design of the speed and sound in worst case conditions was verified by firings at Nicolet, Canada, in January 1976. ERDA Laboratories completed structural and functional firings of advanced warhead and firing set designs which were proven in an underground nuclear test in The training projectiles, container, fuze setter, and handling equipment were designed and tested. Initial review by the Nuclear Weapon System Safety Committee verified the safety of the design.

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A

Title Nuclear Munitions

Project #D663

Title Improved 8-Inch Nuclear Projectile

Engineering Development Testing and Joint Energy Research and Development Administration/Army (ERDA/Army) testing continued. Ballistic similitude of the XM753 and the XM650 high explosive projectile was verified by ballistic tests. Successful fuze flight tests were conducted. The ERDA laboratories continued their structural tests and further refined their designs. Production of hardware for started.

2. FY 1977 Program: testing will start and is oriented toward type classification (at Development Acceptance In-Process Review (DEVA IPR)) of Army components. Joint ERDA/Army testing continues. of ERDA components will be effected for initial Test firings will include fully instrumented structural and functional projectiles to be fired in the most severe temperature and high stress environments, fuze safety test projectiles, and a second series of ballistic tests to compare the nuclear projectile with the XM650 high explosive projectile. Training projectiles, containers, and test and handling equipment will be evaluated in troop tests. Procurement funding will be released for Low Rate Initial Production of the fuze, and projectile training and handling equipment.

3. FY 1978 Planned Program: and joint ERDA/Army testing will be completed to establish statistical safety and reliability in all desired environments. Fuze safety will be established through completion of the fuze safety test; followed by completion of fuze firing table series. Fifty war reserve prototype projectiles with simulated nuclear material will be fired. The firing table series to develop firing tables for the M10/M115 and the improved M10 series howitzers will be started. This series will be fired with 440 XM650 and 440 firing table projectiles. Low Rate Initial Production of Test and Handling equipment and initial war reserve items will continue. Low Rate Initial Production of the remaining war reserve items will start. The RDPE funding level for FY 1978 will be reduced over that required in FY 1977 since hardware for funds, and FY 1978 is largely devoted to completion of

4. FY 1979 Planned Program: FY 1979 will be characterized by

The firing table series will be complete with firing tables being distributed. Training projectiles Test and Handling equipment will be issued, and unit training will be completed to permit a training

The funding level for FY 1979 is significantly reduced over FY 1978 level due to phase of the program. ERDA plans to

5. Program to Completion: will continue to program completion.

Budget Activity #4 - Tactical Programs

Program Element #6.46.03.A

Project #D663

5. Major Milestones:

Title Nuclear Munitions

Title Improved 8-Inch Nuclear Projectile

Estimated RTE Cost to  
Reach Events (Cumulative)

Date

- a. Joint Energy Research and Development/Department of Defense Development  
b. Development Testing/Operational Testing II  
c. Development Acceptance In-Process Review and ERDA Design Release for prototype production  
d. Low Rate Initial Production  
e. Unit training Initial Operational Capability & Production Validation In-Process Review  
f. Initial delivery of War Reserve Projectiles

Dec 1974

RESOURCES: (\$ in Thousands)

|                       | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional<br>to<br>Completion | Total<br>Estimated<br>Cost |
|-----------------------|---------|---------|---------|---------|--------------------------------|----------------------------|
| RTE: Funds            | -       | -       | -       | -       | -                              | -                          |
| Quantities *          | -       | -       | -       | -       | -                              | -                          |
| Procurement:<br>Funds | -       | -       | -       | -       | -                              | -                          |

1/ In CY 1976 dollars, based on tentative stockpile level identified in the August 1975 Program Decision Memorandum.

\* Not feasible to list.

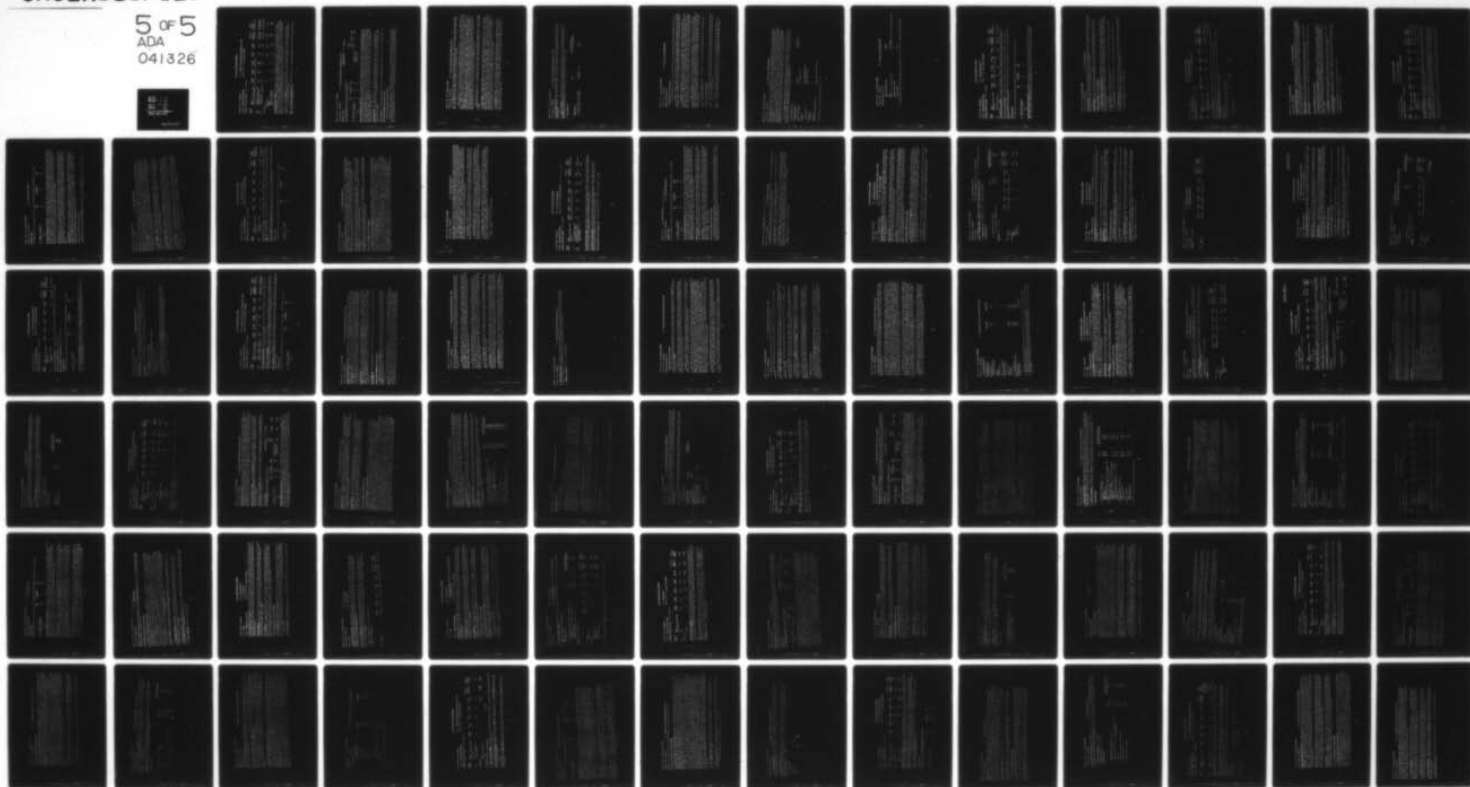
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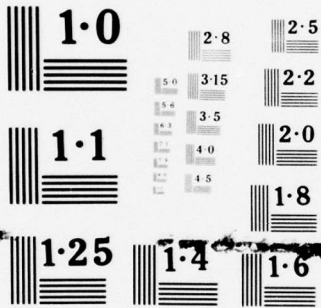
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NATIONAL BUREAU OF STANDARDS  
MICROCOPY RESOLUTION TEST CHART

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.05.A

Title Field Artillery Weapons and Ammunition, 105mm

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|--|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | TOTAL FOR PROGRAM ELEMENT  | 7539    | 1885    | 1617    | 1892    |                                     |                                     |
|                | Quantities (Not feasible to list due to number of diverse items) |         | 6878    |         |         |                                     |                                     |
| D028           | Ammunition, Cannon, 105mm  | 778     | 662     | 0       | 0       | Continuing                          | Not Applicable                      |
| D369           | Improved Conventional Ammunition                                 | 3621    | 1223    | 934     | 1000    | Continuing                          | Not Applicable                      |
| D376           | Howitzer, light, 105mm XM204                                     | 3140    | 0       | 683     | 892     | Continuing                          | Not Applicable                      |
| Procurement:   |  |         |         |         |         |                                     |                                     |
|                | Funds  | 1000    |         | 13200   | 22700   | 234200                              | 271100                              |
|                | Quantities   |         |         |         |         |                                     |                                     |
|                | XM204  | 0       | 0       | 8       | 54      | 987                                 | 1049                                |
|                | XM710 (in Thousands)   | 0       | 0       | 0       | 35      | 422                                 | 457                                 |
|                | XM622 (in Thousands)   | 0       | 0       | 15      | 0       | 0                                   | 15                                  |

BRIEF DESCRIPTION OF ELEMENT: This program element is concentrating on the development of weapons and ammunition to be used throughout the Army. The XM710 is an improved conventional munition and the XM622 is a new antitank projectile. The XM204 is a replacement for the current 105mm howitzers (M101A1 and M102) that have operational limitations. A new recoil technology (soft recoil) is being developed and employed in the XM204. Soft recoil was considered as a possibility in the 1950's, proved feasible during the sixties and is now nearing final development as a part of the XM204. The United States leads in this technological breakthrough, which constitutes a revolutionary development in the field of cannon artillery.

BASIS FOR FY 1978 RDTE REQUEST: FY 1978 Funds are required to continue system management of the XM204, conduct the XM204 Development Acceptance In-Process Review, provide engineering support for Arctic testing, and develop antitank projectiles and improved conventional munition (ICM) projectiles.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The antitank projectile completes development in FY 1977, and the ICM projectile and XM204 howitzer near completion in FY 1978.

Title Field Artillery Weapons and Ammunition, 105mm

**TERMINATION COST: (\$ in Thousands)**

FY 1977

|                            | RDTE | PROCUREMENT | TOTAL |                       | Prior and FY 1978 | Total |
|----------------------------|------|-------------|-------|-----------------------|-------------------|-------|
| (1) Federal Civ. Employees | 47   | 0           | 47    | (1) Estimated Govern- | 23896             | 24592 |
| (2) Contractor Employees   | 32   | 148         | 180   | ment Liability        |                   |       |
|                            |      |             |       | Financed with:        |                   |       |
| Total                      | 79   | 148         | 227   |                       |                   |       |

**RELATED ACTIVITIES:** This system was developed from exploratory and advanced development research, test and analysis of soft

WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Watervliet, NY; Dover, NJ; and Rock Island, IL.

1. FY 197T, FY 1976, and Prior Accomplishments:

Fabricated and tested an XM204 prototype during FY 68 through FY 70. Full scale development was approved in FY 73. Design and fabrication of engineering development prototype numbers one and two were initiated in FY 73 with delivery in FY 74. Fabrication of engineering development prototypes three through eight was initiated in FY 74 with deliveries in FY 75 for Development Test II and Operational Test II (DT and OT II). A special In-Process Review (IPR) was held in June 1974 and provided for a decision

Budget Activity #4 - Tactical Programs

Program Element #6.46.05.A

Title Field Artillery Weapons and Ammunition, 105mm

to use the XM200 propelling charge for achieving extended range with the XM204. Initial Operational Test (OT) II began in May 1975, and revealed the first significant problems to be encountered with this weapon. Due to these problems (misfires, howitzer hop, latch failures and wheel actuator breakages), OT II was terminated in June 1975.

Data was used from the initial OT II as guidance in redesigning and modifying the XM204. OT II was to be resumed in Jan 76, but was cancelled due to continued presence of some weapon baseplate hop on misfire and lack of stability while firing on 10° side slope. A General Officers Review was held in Feb 76 and direction was received to modify the weapons to further reduce the weapon baseplate hop to an absolutely safe level and to make the weapon stable while firing on slopes of up to 10°. Producibility, Engineering and Planning (PEP) activities were suspended awaiting the design revisions and PEP funds remaining unspent were transferred to ~~EMTS~~ to pay for weapon rework and modification. Concepts to eliminate baseplate hop and to improve side slope stability were tested at Jefferson Proving Ground. Prototype modifications were initiated in June. One unmodified weapon was shipped to Australia in Jun 76 to participate in an Australian Standardization Loan/Tropic Test/Tropic Trails. Development of the XM710 improved conventional ammunition continued with design qualifications to meet the XM200 propelling charge environment, and underwent engineering design tests. XM710 projectiles were fabricated for development test II/operational test II (DT II/OT II). Work was conducted on a full frontal area impact switch (FFais) for the 105mm HEAT cartridge.

Rework and modification of S/N 3 - 8 continued during FY 1977. The weapon in Australia was damaged during a road test mishap, but weapon has been repaired and is continuing through the test program. Engineering development continued in the XM710 and XM622 programs.

2. FY 1977 Program: The XM622 high explosive anti-tank (HEAT) cartridge will under go development test II (DT II) and be type classified. Sufficient XM710 projectiles will be fabricated to conduct operational testing and development testing. The XM204 will undergo modification and rework of S/N 3 - 8, less S/N 6 which is in Australia. OT II testing will be initiated in February/March with the operational phase being completed in July at Fort Campbell, Kentucky. One weapon successfully withstood a simulated atomic blast (DICE THROW) at White Sands Missile Range in October. This weapon will be loaned to the Marines for amphibious landing/testing in December. The weapon loaned to the Australians will be returned in July after which it will be repaired and modified, as required. A howitzer, to be loaned to the Canadians in January 1977, will be returned in July. The Production, Engineering and Planning (PEP) phase will be re-initiated and will take 12 months to complete.

3. FY 1978 Planned Program: Development testing and operational testing will be completed on the XM710 projectile, and the projectile will be type classified. The Development Acceptance In-Process Review (DEVA IPR) for the XM204 is scheduled for Dec 77. The production phase of the program is planned to begin with an initial buy of 8 howitzers for DT & OT III, but will be dependent upon the results of the IPR. Funding requirement is decreased as the XM710 projectile and XM204 howitzer complete the major portion of the development effort.

Budget Activity #4 - Tactical Programs

Program Element #6.46.05.A Title Field Artillery Weapons and Ammunition, 105mm

4. FY 1979 Planned Program: The random time delay submunition which was developed in program element 6.36.28.A, Field Artillery Weapons and Ammunition, will begin engineering development. The low rate initial production of eight howitzers for DT/OT III will be in progress.

5. Program to Completion: The first eight production howitzers will be delivered in the first and second quarters of FY 80 with Developmental Test and Operational Test III (DT and OT) taking place in third and fourth quarters. The Production Validation In-Process Review (PV IPR) is scheduled for the first quarter FY 81. This is a continuing program.

6. Major Milestones:

| Date | Estimated RDTE Cost to<br>Reach Events (Cumulative) |
|------|---|
|------|---|

XM204 Howitzer

|                                     |                    |       |
|-------------------------------------|--------------------|-------|
| a. Complete Advanced Development    | 4th Quarter, FY 73 | 5500  |
| b. Complete Engineering Development | 1st Quarter, FY 78 | 24241 |



Budget Activity #4 - Tactical Programs

Program Element #6.46.05.A

Title Howitzer, Lt Towed 105mm, XM204

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

- a. The XM204 program is an Army in-house effort with Rock Island Arsenal being responsible for management and production.
- b. A series of tests were conducted from June 1969 to February 1974 that were essentially equivalent to the current Development Test I (DT I). A combined total of 10,305 rounds were fired by the Military Potential, Advanced Development and Engineering development XM204 prototypes during various tests conducted from 1969 until February 1974. The prototypes performed very well.
- c. The XM204 testing program is currently in DT II. During tube wear tests, a Mean Rounds Between Failure (MRBF) of 1,561 was achieved. Further tube wear testing will be completed September 1977 at Aberdeen Proving Ground (APG) by firing 15,000 rounds through two new tubes. The tube wear test is fired with the XM200 charge to provide the required full charge. DT II environmental tests are scheduled and should be completed by September 1978. Desert testing is being accomplished during Operational Testing (OT) II. Other scheduled DT II tests include formal firing tables firing, airdrop, additional durability testing and a combined transportation test and maintenance evaluation which is all scheduled for completion by the end of February 1978.
- d. The XM204 performed well with no significant problems during all testing prior to Operational Test (OT) II which was initiated during the 4th Quarter of FY 1975. The test was prematurely terminated due to excessive misfires and other failures and the prototype howitzers were returned to the materiel developer for corrective fixes. Initial fixes were not considered to be completely satisfactory and the program was restructured in February 1976 to accommodate further design changes. A special check test will be started during December 1976 at Aberdeen Proving Ground (APG) to verify that the XM204 howitzer is ready to resume OT II in March 1977.
- e. Initial production XM204 howitzers will undergo DT III from April 1980 to September 1980 at APG. An estimated 23,000 rounds will be used for the test.

2. Operational Test and Evaluation:

- a. Service testing was conducted from August 1970 to February 1971 under field conditions by the Field Artillery Board using a 105mm howitzer crew. Department of the Army (DA) approval on 28 June 1973 of the Concept Formulation In-Process Review (IPR) moved the program to full scale development.
- b. DT II was to be conducted by the Operational Test and Evaluation Agency (OTEA) at Fort Sill, OK, from 8 April to 26 September 1975. The test was to consist of a series of field exercises employing an augmented Artillery Battery composed of three prototype XM204 and three M102 howitzers. Operational Test (OT) II was terminated on 13 June 1975 due to excessive

# **Budget Activity #4 - Tactical Programs**

Program Element #6.46.05.A

Title Howitzer, Lt Towed 105mm, XM204

reliability failures of the system. Live firing included 4,557 rounds of the intended 15,000 Reliability, Availability, Maintainability (RAM-X) exercise rounds. Early in the test, failures occurred that required component modification beyond the general support maintenance level. As a result of a General Officer review, testing (OT IIA) has been rescheduled to begin in March 1977, at Ft Campbell, KY. OT IIA will compare operational performance of the XM204 and M102 system which it is designed to replace, under varying terrain, light and tactical conditions. Additionally, a desert climatic test phase will be conducted at Yuma PG in August 1977 with one XM204 to evaluate suitability of the system under desert conditions. A combined Development Test (DT)/OT II air movement phase of testing will be conducted from October to November 1977 to determine if the XM204 and its crew can effectively participate in Phase I of air assault operations. The Operational Test and Evaluation Agency (OTEA) will provide an independent evaluation of OT IIA for the Development Acceptance (DEVA) In-Process Review (IPR) to facilitate a production decision.

c. OT III is planned using six initial production XM204 howitzers, and is to be conducted by OTEA at Ft Bragg, NC, from April 1980 to July 1980. The test will employ a full strength Field Artillery Battery (105mm) equipped with six production XM204 howitzers for a series of operational exercises in a simulated tactical environment. The OTEA OT III Independent Evaluation will be used as a basis for a full scale decision at a Production Validation IPR.

## 3. System Characteristics:

### Operational/Technical Characteristics

Range - XM200 Charge

Durability

Tube Life

Carriage Durability

Operational Availability

Reliability

(Mean Rounds Between Failures)

### Objective

14.7 Kilometers (km)

3,000-7,500 Equivalent Full

Charge (EFC) rounds

15,000-22,500 EFC rounds

.85

(1,200 minimum - 2,000 specified)

rounds

/ System performance to be demonstrated during DT II and OT IIA.

Demonstrated I/  
Performance

Budget Activity #4 - Tactical Programs

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Additional Characteristics -

Weapon and Vehicles Only

Crew

Weight

Rate of Fire - Maximum/Sustained

System Accuracy, XM200

Range-M67 Charge

Current

9

5,050 Pounds

12-15 Rds Per Minute for 3 minutes/3-5 Rds Minute

2/

11.9 km

2/ To be finalized during formal firing tables firing scheduled from Aug 77 to Feb 78 at Aberdeen Proving Ground (APG).

Title Howitzer, Lt Towed 105mm, XM204

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.06.A

Title Explosive Demolitions

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost |
|----------------|--|---------|---------|---------|---------|-------------------------------------|----------------------|
|                |  |         |         |         |         |                                     |                      |
|                | TOTAL FOR PROGRAM ELEMENT Quantities         | 352     | 459     | 95      | 1563    |                                     | Not Applicable       |
|                | Consists of a large number of diverse items. |         |         |         |         |                                     |                      |
| D021           | Explosive Demolitions                        | 352     | 200     | 459     | 1563    | Continuing                          | Not Applicable       |

BRIEF DESCRIPTION OF ELEMENT: Provides for development of explosives for demolition, firing devices, special purpose items for General Army, Special Forces, and Technical Escort, and special tools and kits for Explosive Ordnance Disposal (EOD) units.

BASIS FOR FY 1978 RDTE REQUEST: Initiate design of components for a bulk explosive system consisting of inert components.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Decrease in funding reflects type classification in FY 1977 of XM122 remote firing device.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 2    | 0           | 2     |
| (2) Contractor Employees   | 2    | 0           | 2     |
| Total                      | 4    | 0           | 4     |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop a series of explosive demolition items used for aiding friendly mobility and providing barriers to enemy movement. Items include firing devices, explosives, and special purpose items. Special items for US Army Technical Escort and Explosive Ordnance Disposal (EOD) units are developed in this program.

Budget Activity #4 - Tactical Programs

| <u>Program Element</u> | <u>#6.46.06.A</u> | <u>Title</u> | <u>Explosive Demolitions</u> |
|------------------------|-------------------|--------------|------------------------------|
|------------------------|-------------------|--------------|------------------------------|

RELATED ACTIVITIES: In FY 1974, this program element contained projects providing for the development of artillery delivered mines. These projects have been transferred to Program Element 6.46.19.A, Mine Systems. Explosives investigations in this program element are under the monitorship of the Joint Armed Services Explosives Safety Board.

WORK PERFORMED BY: The principal Army agency is US Army Armament Research and Development Command (ARRADCOM), Dover, New Jersey. Principal contractors are: Hercules Incorporated, Wilmington, Delaware; and Teledyne McCormick Selph, Hollister, California.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Past standardized items include an overhead foxhole cover, a lightweight X-ray set for explosive ordnance disposal (EOD) teams, and the M252 cutting and entry tool kit. The XM122 remote demolition firing device entered Developmental Testing II/Operational Testing II. The general purpose barbed tape obstacle and the M180 cratering charge were type classified standard. Efforts were initiated on the bulk explosive system, the vehicle mounted explosive container, and the hard overpack.
2. FY 1977 Program: Conduct testing of a bulk explosive system. Continue efforts on the hard overpack for leaking chemical munitions. Type classify the XM122 remote firing device.
3. FY 1978 Planned Program: Initiate design of components for a bulk explosive system consisting of inert components.
4. FY 1979 Planned Program: Conduct Development Testing II/Operational Testing II on the bulk explosive system. Initiate development of a vehicle mounted explosive container, a miniature manportable torch, and a carrying pouch for electric blasting caps. Increased funding required to procure test hardware on bulk explosive system.
5. Program to Completion: This is a continuing program.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.08.A

Title: Army Small Arms Program

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES [PROJECT LISTING]: (\$ in Thousands)

| Project Number | Title                            | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|----------------------------------|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | TOTAL FOR PROGRAM ELEMENT        | 400     | 0       | 485     | 500     |                                     |                                     |
|                | Quantities                       |         |         |         |         |                                     |                                     |
| DF21           | NATO Small Arms Evaluation       | 0       | 0       | 485     | 500     | Continuing                          | Not Applicable                      |
| D566           | Civil Disturbance Control Weapon | 400     | 0       | 0       | 0       | 0                                   | Not Applicable                      |

BRIEF DESCRIPTION OF ELEMENT: This program element (PE) includes support for NATO Small Arms Test/Evaluation beginning April 1977.

BASIS FOR FY 1978 RDTE REQUEST: Continue support of US contenders for the NATO Small Arms Test/Evaluation.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The increase is based on the best estimate available from the United Kingdom and the Federal Republic of Germany where the tests will be conducted.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                           | RDTE | PROCUREMENT | TOTAL |
|---------------------------|------|-------------|-------|
| (1) Federal Civ Employees | 2    | 0           | 2     |
| (2) Contractor Employees  | 0    | 0           | 0     |
| Total                     | 2    | 0           | 2     |

Budget Activity #4 - Tactical Programs

Program Element #6.46.08.A

Title Army Small Arms Program

DETAILED BACKGROUND AND DESCRIPTION: This program element (PE) encompasses the engineering development (ED) projects that support the Army Small Arms Program (ARSAP). Current objectives of this PE are to provide support for NATO rifle machinegun and ammunition tests and the further development of a nonlethal civil disturbance control device. The purpose of the NATO Small Arms Test/Evaluation is to ensure standardization of small arms ammunition of the armed forces of the alliance for eventual standardization of small arms weapons systems in the 1980's.

RELATED ACTIVITIES: The projects in the PE represent the primary sources of military small arms ED for all services. These projects are monitored by other services with representatives attending Ad Hoc coordination meetings.

WORK PERFORMED BY: In-house efforts are accomplished by the US Army Armaments Research and Development Command, Dover, NJ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: ED of 40mm signal cartridges was initiated and completed. ED was initiated on star parachute and smoke canopy rounds. Development and fabrication of approximately 4,000 star parachute and smoke canopy rounds for Operational Test II (OT II) was accomplished. Development testing of the Sting Ring Airfoil Grenade (RAG) was initiated. Sting RAG hazard criteria was verified by biophysics tests. Testing and aeroballistic analysis will be conducted to verify flight performance characteristics. Hardware required to conduct engineering design testing was procured for the Sting RAG.
2. FY 1977 Program: Development will be completed for the launcher/adaptor for the M16 rifle to enable firing of a kinetic energy projectile for use in civil disturbance operations. First funding of NATO tests will be initiated.
3. FY 1978 Planned Program: Continue support of the NATO Small Arms test with personnel, weapon systems (M16A1 and Improved 5.56mm ammunition) and special equipment that may be required. Slight increase in FY 1978 over FY 1977 is attributed to peak of testing requirements.
4. FY 1979 Planned Program: Support of the NATO Small Arms test will continue.
5. Program to Completion: This is a continuing program.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.09.A

Title Combat Support Systems

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/ : (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT | FY 1976<br>631 | FY 1977<br>383 | FY 1978<br>1957 | FY 1979<br>2620 | FY 1980<br>3957 | Additional to Completion Continuing | Total Estimated Cost<br>Not Applicable |
|----------------|------------------------------------|----------------|----------------|-----------------|-----------------|-----------------|-------------------------------------|--|
|                |                                    |                |                |                 |                 |                 |                                     |  |
| DE96           | Tactical CS Agent Munition         | 340            | 300            | 494             | 0               | 1070            | Continuing                          | Not Applicable                         |
| DI91           | Flame, Smoke Weapon and Equipment  | 0              | 0              | 922             | 2131            | 2887            | Continuing                          | Not Applicable                         |
| D638           | Civil Disturbance Control System   | 291            | 83             | 541             | 489             | 0               | Continuing                          | Not Applicable                         |

**BRIEF DESCRIPTION OF ELEMENT:** This program element supports engineering development (ED) of new and improved smoke munitions and smoke protective systems; flame and incendiary equipment; new and more effective riot control agent munitions, devices and equipment for both tactical use and for controlling civil disturbances.

**BASIS FOR FY 1978 RDTE REQUEST:** Funds are needed to continue ED of the XM742 Soft Ring Airfoil Grenade (SOFT RAG) projectile including funding of the ED contract, execution of engineer design tests, and Development Test II/Operational Test II; complete interface development of rapid smoke protection systems for top priority US armored vehicles, and initiate prototype hardware manufacture of vehicle exhaust smoke generating system. The smoke exhaust system complements the rapid smoke protection systems being adopted to US armored vehicles.

**BASIS FOR CHANGE IN FY 1978 OVER FY 1977:** The increased funds are needed to satisfy Army high priority requirements for smoke protective systems to counter enemy surveillance and target acquisition of armored vehicles. Included are improved/new smoke munitions and materiel.

Budget Activity #4 - Tactical Programs

Program Element #6.46.09.A

Title Combat Support Systems

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 4           | 0                  | 4            |
| (2) Contractor Employees   | 28          | 0                  | 28           |
| Total                      | 32          | 0                  | 32           |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this element is to provide rapid smoke protection for US armored vehicles to include the following: application of the M239 smoke grenade launcher to M60, M60A1/A3, M60A2, XM1 and M48A5 tanks, M728 M88 CEV and VTR; development of a 4-tube discharger launcher system for application to the Mechanized Infantry Combat Vehicle and Improved TOW Vehicle and others. Additionally, a vehicle exhaust smoke generating system for the M60A1/A3 tanks and other US diesel-driven armored vehicles is being developed. This system will complement the grenade launcher smoke system. The other objective of this program is to develop new and more effective riot control agent munitions, devices and equipment for both tactical use and for controlling civil disturbances; and new and improved flame and incendiary equipment.

RELATED ACTIVITIES: The Army is Department of Defense (DOD) executive agent for development of civil disturbance control systems. The other Services sponsor engineering development for materiel unique to each. Liaison personnel from each Service monitor the developing agencies programs and joint committees meet regularly to review Service needs and insure development programs are oriented to satisfy joint needs. This program is supported by Program Elements 6.26.22.A, Chemical Munitions and Chemical Combat Support and 6.36.27.A, Combat Support Munition. Project DI91 was originally part of Program Element 6.46.01.A, Infantry Support Weapons.

WORK PERFORMED BY: Smoke Systems: Program will be managed by the Project Manager - Smoke/Obscurants Office; approximately 80% of armored vehicle protection systems effort will be in-house by US Army Armament Research and Development Command (ARRADCOM), Edgewood, MD and 20% will be Test and Evaluation Command test effort; 50% of the vehicle exhaust smoke generating system will be in-house by ARRADCOM, Edgewood, MD and 50% will be contractual effort with Teledyne Continental Motors Corporation. Other efforts under this program will be by US Army Test and Evaluation Command and ARRADCOM, Aberdeen, MD; Pine Bluff Arsenal, AK; Armament Research and Development Command (ARRADCOM), Dover, NJ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1971, FY 1976, and Prior Accomplishments: Numerous tactical CS munitions and civil disturbance control munitions and devices completed development and were type classified under this program element. Examples include: M629, 105m Tactical CS projectile;



**Budget Activity #4 - Tactical Programs**

**Program Element #6.46.09.A Title Combat Support Systems**

M630, 4.2 inch Tactical CS projectile; M651, 40mm Tactical CS Cartridge; a 2.75 inch CS air-to-ground rocket; M165 Multipoint Source Cluster; and the M674 Riot Control Agent Cartridge. Engineering development was initiated on several other civil disturbance control devices: XM33 riot control agent dispenser; XM47 CS filled grenade and XM32 hand held CS dispenser for use by military police units. Engineering development continued on the XM96, 66mm Tactical CS rocket. Emphasis was on improving producibility of the warhead and increasing the agent payload. In FY 74 the M47 CS grenade and M48 training grenade completed development and were adopted as standard. Its spherical shape and skittering characteristics minimize the possibility of rioters will throw the grenade back at the crowd control unit. The M33 Portable, backpack dispenser was adopted for use with CS. Engineering development was initiated on the XM742 Projectile (SOFT RAG) in FY 1976. Completed concept feasibility testing and supported user evaluation tests of the vehicle exhaust smoke generating system. Finally, in FY 1976 completed development and user testing and type classified M239 launcher (6-tube) and L8A1 Smoke Grenade for M60A1/A3 Tanks, and initiated design of a 4-tube launcher for other types of armored vehicles.

2. FY 1977 Program: Complete development and type classify a 4-tube launcher for infantry vehicles; initiate development of rapid smoke systems for M60A2 tank and Armored Vehicle Launching Bridge (AVLB); initiate contractor development effort to optimize the vehicle exhaust smoke system for maximum smoke production, and provide for system interchange across all US diesel-driven armored vehicles; continue engineering development of the XM742 Soft Ring Airfoil Grenade (RAG) projectile. The 66mm Tactical Rocket will be type classified and adopted as standard.

3. FY 1978 Planned Program: Complete interface development for top-priority vehicles referenced above; complete development of rapid smoke systems for M60A2 Tank and AVLB, initiate development of interface kits and, if required, launchers for add-on vehicle requirements; conduct Design Characteristics Technical Review of the Vehicle Smoke Exhaust System and initiate prototype hardware manufacture; initiate and complete Development Tests/Operational Tests II (DT II/OT II) of the XM742 SOFT RAG projectile. Also, engineering development (ED) continues on a shaped charge incendiary follow through projectile. The increase in funds are needed to support these high priority programs which will improve the survivability of armored and mechanized forces.

4. FY 1979 Planned Program: Complete interface development of rapid smoke protective systems for remainder of required vehicles; continue development of launchers/interface for add-on vehicles; conduct Development Validation In-Process Review and type classify the systems; continue coordination efforts. The XM742 SOFT RAG projectile will be type classified; and engineering development will commence on convoy protection and isolated personnel rescue systems using riot control agents. The increase in funds will insure the timely adaptation of smoke protective systems to the remaining armored and mechanized forces.

5. Program to Completion: This is a continuing program.



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.10.A

Title Lethal Chemical Munitions

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                            | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to         |                       | Total Estimated Cost |
|----------------|----------------------------------|---------|---------|---------|---------|-----------------------|-----------------------|----------------------|
|                |                                  |         |         |         |         | Completion Continuing | Completion Continuing |                      |
| DF94           | Lethal Chemical Ground Munitions | 3503    | 1448    | 2771    | 2175    |                       |                       | Not Applicable       |

BRIEF DESCRIPTION OF ELEMENT: This program provides for engineering development of binary lethal chemical weapons and equipment.

BASIS FOR FY 1978 RDTE REQUEST: Funds the continuation of engineering development (ED) efforts on the 8-inch binary VX projectile, XM736.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The decrease in funds is due to the expected completion of hardware procurement/fabrication of the 8-inch binary VX projectile in preparation for Development Test II/Operational Test II.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement) is as follows:

|                            | RDTE |  | PROCUREMENT |  | TOTAL |
|----------------------------|------|--|-------------|--|-------|
| (1) Federal Civ. Employees | 50   |  | 0           |  | 50    |
| (2) Contractor Employees   | 0    |  | 0           |  | 0     |
| Total                      | 50   |  | 0           |  | 50    |

**Budget Activity #4 - Tactical Programs**

Program Element #6.46.10.A

**Title Lethal Chemical Munitions**

**DETAILED BACKGROUND AND DESCRIPTION:** The objective of this program is to develop new binary lethal chemical weapons and equipment for the Army and for other Services when use is also common to the Army. The objectives of this program were changed in 1970 and currently support only the development of chemical munitions which produce the toxic agent via the binary mode. A binary weapon is one in which the agent is produced from its components by means of a chemical reaction occurring during the time of flight of the munition to the target. This system will provide for maximum safety in handling, storage, transportation and demilitarization and at the same time optimize state-of-the-art advances to insure maximum target effectiveness.

**RELATED ACTIVITIES:** The Navy, Air Force and Marine Corps conduct engineering development for weapons unique to each. Information is exchanged and efforts are coordinated through exchange of RDT&E documents, and liaison visits. Also, formal joint committees meet regularly to avoid duplication of effort in the solution of related problems. Advanced development efforts are supported by Program Element 6.36.15.A, Lethal Chemical Munitions Concepts.

**WORK PERFORMED BY:** US Army Armament Research and Development Command (ARRADCOM), Edgewood, Maryland, is the primary Army development laboratory with participation by ARRADCOM, Dover, New Jersey; US Army Test and Evaluation Command (TECOM) and ARRADCOM, both at Aberdeen, Maryland; and Dugway Proving Ground, Dugway, Utah.

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. FY 1977, FY 1976, and Prior Accomplishments: The following weapons were developed in previous years to provide an offensive lethal chemical warfare capability for the Army: Honest John, Little John and Sergeant missile chemical warheads; chemical rounds for the 155mm and 8-inch howitzers; 155mm lethal chemical multiple rocket system; lethal warhead for the LANCE missile; however, in FY 1971 the program was terminated pending the development of a suitable binary submission. During FY 73 engineering development was initiated on the XM687, binary GB, 155mm projectile. In FY 74 the Development Test (DT) II for the 155 binary GB projectile, XM687, continued generally in accordance with the test plan. Problems with achieving ballistic similitude with the M483 projectile (base round for the XM687) caused some delay in the program. However, program planning was expanded to include participation in the M483 projectile investigation-corrective program to minimize risk and provide a possible basis for eventual resolution of the problem with satisfaction of ballistic similitude requirements. The 2 year DT II effort was completed in 3QFY76 and the results were evaluated against the Materiel Need requirements. Operational Test (OT) II of the 155mm GB2 projectile was conducted in 4QFY76 and FY 77. DT II and OT II test results and independent evaluations by TECOM and US Army Training and Doctrine Command, Fort Monroe, Virginia (TRADOC) will be presented at a formal development acceptance (DEVA) in-process review meeting in support of type classification. Concurrent with the DT II and OT II efforts, engineering support efforts were directed toward providing the required production data base. The Validation Phase was successfully completed and the Engineering

**Budget Activity #4 - Tactical Programs**

**Program Element #6.46.10.A**

**Title Lethal Chemical Munitions**

- Development Phase on the 8-inch binary VX projectile, XM736 was initiated in 3QFY74; in addition, acquisition of the engineering design test hardware was initiated and a draft Coordinated Test Plan (CTP) for the 8-inch projectile was prepared and circulated for coordination. In FY 75 engineering development efforts continued on the 8-inch projectile with completion of projectile metal parts, continuation of internal hardware fabrication and initiation of fill, close, and Load, Assemble and Pack (LAP) operations; also certain phases of engineering development testing (EDT) commenced. The EDT of the 8-inch VX projectile was completed; and a Prototype System Characteristics Technical Review (PSTR) was conducted in FY 77. Producibility Engineering and Planning (PEP) efforts were continued. In addition, a preliminary technical data package (TDP) was in preparation and the operator's manual was updated for the 8-inch binary VX round. Procurement of hardware for Research and Development Acceptance Test (RDAT) and for Development Test II/Operational Test II (DT II/OT II) was initiated.
2. **FY 1977 Program:** The RDAT for the 8-inch binary VX projectile will be conducted to verify suitability of hardware design for DT II and OT II. DT II/OT II hardware procurement/fabrication will be continued and the DT II effort will be initiated. Concurrently, engineering and engineering support efforts will be directed toward providing the required production data base.
3. **FY 1978 Planned Program:** Hardware preparation of DT II/OT II of the 8-inch binary VX projectile will be completed. The DT II effort will be completed and the OT II program will be implemented. The test results will be independently evaluated by US Army Test and Evaluation Command, and US Army Training and Doctrine Command and the Development and Acceptance In-Process Review will be held as the prelude to type classification. The decrease in funds is due to the completion of hardware procurement/fabrication of the 8-inch binary VX round in preparation for Development Test II/Operational Test II.
4. **FY 1979 Planned Program:** Engineering development efforts on the 155mm intermediate volatility agent (IVA) projectile utilizing the binary principle will commence. Design concepts from advanced development will be engineered and test hardware fabrication will begin. Testing to support the engineering effort and to validate novel design concepts will be performed. An engineering design test (EDT) program will be developed. The decrease in funds is due to the expected completion of engineering development of the 8-inch binary VX projectile.
5. **Program to Completion:** This is a continuing program.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.12.A

Title Countermine and Barriers

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| <u>Project Number</u> | <u>Title</u>                                       | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional to Completion Continuing</u> | <u>Total Estimated Cost Not Applicable</u> |
|-----------------------|--|----------------|----------------|----------------|----------------|--|--|
|                       | <u>TOTAL FOR PROGRAM ELEMENT</u>                   | <u>2335</u>    | <u>790</u>     | <u>6202</u>    | <u>13925</u>   |  |  |
|                       | Quantities   |                |                |                |                |  |  |
| D145                  | Surface Launched Unit Fuel Air Explosive (SLUF AE) | 0              | 0              | 3781           | 5254           | 6500                                       | 15535                                      |
| D415                  | Mine Neutral/Detection                             | 2335           | 5298           | 2421           | 3271           | Continuing                                 | Not Applicable                             |
| D556                  | Surface Launched Unit Mine Rocket (SLUMINE)        | 0              | 0              | 0              | 5400           | 12600                                      | 18000                                      |

BRIEF DESCRIPTION OF ELEMENT: The objective of this program is the engineering development of a group of mutually supporting mine detection and neutralization devices capable of defeating mines and booby traps on lines of communication and off route environments. SLUMINE is included in this program because it is fired from the SLUF AE launcher.

BASIS FOR FY 1978 RDTE REQUEST: Complete engineer design testing and begin Developmental Testing II/Operational Testing II (DT II/OT II) on the Surfaced Launched Unit Fuel-Air Explosive (SLUF AE). Conduct DT II/OT II on the mine clearing roller. Continue engineering development of the route interdiction mine detector (RIMD).

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Increased funding required to purchase test hardware for SLUF AE.



Budget Activity #4 - Tactical Programs

Program Element #6.46.12.A Title Countermine and Barriers

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 58          | 0                  | 58           |
| (2) Contractor Employees   | 100         | 0                  | 100          |
| Total                      | 158         | 0                  | 158          |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is the engineering development of a group of mutually supporting mine detection and neutralization devices. The Surface Launched Unit Fuel-Air Explosive (SLUF AE) will provide the first rapid breach standoff capability for clearing a path through an identified minefield. The mine clearing roller will provide organic mine detection/neutralization capability to tank units. The road interdiction mine detector (RIMD) will provide the capability to detect both metallic and non-metallic antitank mines at a rapid rate along roads and trails. The surface launched mine rocket (SLUMINE) will provide dual minelaying capability to the SLUF AE launcher. SLUMINE will provide the capability to deliver a large number of scatterable antitank mines over a large area in a very short period of time.

RELATED ACTIVITIES: This program follows from advanced development Program Element 6.36.19.A, Countermine and Barriers. Exploratory development is conducted in Program Element 6.27.33.A, Mobility Equipment Technology. Coordination with the other services is accomplished through reviews and conferences. The Army monitors the joint service Fuel-Air Explosives (FAE-II) program.

WORK PERFORMED BY: The US Army Mobility Equipment Research and Development Command (MERADCOM) is the lead lab for Countermine and Barriers. Other government agencies involved are: Naval Weapons Center, China Lake, California; US Test and Evaluation Command, Aberdeen, Maryland; Yuma Proving Grounds, Yuma, Arizona; and the US Army Missile Research and Development Command (MIRADCOM), Huntsville, Alabama. Contractors include: Chrysler Corporation, Detroit, Michigan; Cubic Corporation, La Jolla, California; and Honeywell Corporation, Hopkins, Minnesota.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: An expendable mine clearing roller was developed for Southeast Asia in 1970. A Track Width Mine Plow (TMP) was developed from a Soviet design but was terminated because of blast vulnerability. The Fuel-Air Explosive, Helicopter Delivered (FAESHED) was developed and tested but was not procured due to helicopter vulnerability. Engineer design tests (EDT) on the SLUF AE were initiated.



Budget Activity #4 - Tactical Programs

Program Element #6.46.12.A                      Title Countermine and Barriers

2. FY 1977 Program: Continue EDT on SLUFAE and procure long lead items for DT II/OT II. Initiate engineering development of the route interdiction mine detector (RIMD) and the hybrid mine clearing roller.
3. FY 1978 Planned Program: Conduct DT II/OT II on SLUFAE and RIMD. Complete DT II/OT II on the hybrid mine clearing roller. Increased funding required to purchase test hardware for SLUFAE, RIMD, and mine roller.
4. FY 1979 Planned Program: Complete DT II/OT II and type classify the SLUFAE. Initiate engineering development of the man portable mine neutralizer (MANPLEX) and close in mine neutralizer (SPRAYFAE). Initiate chemical neutralization of explosives (CHENS). Complete DT II/OT II on the route interdiction mine detector (RIMD). Initiate engineering development of the surface launched scatterable mine rocket (SLUMINE). Increased funds reflects the initiation of engineering development on SLUMINE. All necessary experimental work on SLUMINE has been performed and the proposed system is ready for full scale development.
5. Program to Completion: This is a continuing program.

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.46.12.A

Title Countermine and Barriers

Project #D145

Title Surface Launched Unit, Fuel-Air Explosive (SLUFAE)

Category Engineering Development

Budget Activity #4 - Tactical Programs

**DETAILED BACKGROUND AND DESCRIPTION:** The Surface Launched Unit Fuel-Air Explosive (SLUFAE) consists of a skid-mounted launcher designed to be mounted on a non-dedicated M548 carrier. One to thirty rockets containing propylene oxide may be fired out to a maximum range of 1000 meters to clear a safe lane through an enemy minefield. SLUFAE will provide the first all-weather, stand-off mine neutralization capability.

**RELATED ACTIVITIES:** The project follows from advanced development Program Element 6.36.19.A, Countermine and Barriers, during which Fuel-Air Explosives (FAE) effectiveness against tactical minefields was evaluated. The Army also maintains interest and monitorship in the joint services FAE II program where the Navy is lead service. Joint development plans are coordinated by the Joint Technical Coordinating Group for Air Launched Non-Nuclear Ordnance.

**WORK PERFORMED BY:** The principal Army agency for SLUFAE is the US Army Mobility Equipment Research and Development Command, Fort Belvoir, Virginia. Other government agencies providing support are: US Army Missile Research and Development Command (MIRADCOM), Huntsville, Alabama; Naval Weapons Center, China Lake, California; Naval Surface Weapons Center, Silver Spring, Maryland; and the US Army Test and Evaluation Command, Aberdeen, Maryland. The principal contractors are: International Manufacturing Corporation, Garland, Texas; Teledyne-Brown, Huntsville, Alabama; Lanson Industries, Inc., Cullman, Alabama; Honeywell Incorporated, Hopkins, Minnesota; and Sperry Rand, New York, New York.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: SLUFAE developed as a follow on program to the helicopter delivered fuel-air explosive (FAESHED) program. The FAESHED program adopted a standard Navy CBU-55 FAE weapon for minefield and booby trap clearance. The FAESHED program was dropped in favor of the SLUFAE. Firing tests of this system were conducted in November 1973 and February 1974. SLUFAE completed advanced development and transitioned to engineering development in December 1975. During FY 75 a field resettable fuze was designed, fabricated, and tested. A new fire control intervalometer to interface with the new fuze was designed, built, and tested. A complete system test of SLUFAE against a live tactical minefield to measure the effectiveness in breaching safe lanes was conducted.
2. FY 1977, Program: Procure test hardware and initiate Developmental Testing II/Operational Testing II (DT II/OT II) on the system.
3. FY 1978 Planned Program: Continue DT II/OT II on the system. This is a new project; previous work was carried out in Program Element 6.46.12.A, Project D415. Increased funds required for procurement of test items. This is not a new start.

Budget Activity #4 - Tactical Programs

Program Element #6.46.12.A

Title Countermine and Barriers

Project #D145

Title Surface Launched Unit, Fuel-Air Explosive (SLUF AE)

4. FY 1979 Planned Program: Complete Developmental Testing II/Operational Testing II (DT II/OT II) and type classify the SLUF AE system. Increased funding required to procure and test additional prototype items.

5. Program to Completion: Conduct DT III/OT III on initial production items.

6. Major Milestones:

Estimated RDTE Cost to  
Reach Events (Cumulative)

- a. Type Classification Standard 4Q FY 1979 9159
- b. Production Validation In-Process Review 2Q FY 1981 15659

RESOURCES: (\$ in Thousands)

|  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|--|---------|---------|---------|---------|--------------------------|----------------------|
|--|---------|---------|---------|---------|--------------------------|----------------------|

RDTE: Funds Quantities Includes a number of individual test components.

6500 15535

Procurement:

Funds

Quantities

Launcher

Rounds (each)

|   |   |   |   |   |        |        |
|---|---|---|---|---|--------|--------|
| 0 | 0 | 0 | 0 | 0 | 557700 | 557700 |
| 0 | 0 | 0 | 0 | 0 | 345    | 345    |
| 0 | 0 | 0 | 0 | 0 | 459540 | 459540 |

FY 1978 ROUTE DESCRIPTIVE SUMMARY

|                                  |  |
|----------------------------------|--|
| Program Element #6.46.12.A       | Title Countermine and Barriers         |
| Project #D415                    | Title Mine Neutral/Detection           |
| Category Engineering Development | Budget Activity #4 - Tactical Programs |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is the engineering development of a group of mutually supporting mine detection and neutralization devices capable of defeating mines and booby traps on lines of communication and off route environments.

RELATED ACTIVITIES: The project follows from advanced development Program Element 6.36.19.A, Countermine and Barriers.

WORK PERFORMED BY: The principal Army agency for Mine Neutralization/Detection is the US Army Mobility Equipment Research and Development Command, Fort Belvoir, Virginia. Other governmental agencies providing support are: The US Army Test and Evaluation Command, Aberdeen, Maryland. Principal contractors are: Chrysler Corporation, Detroit, Michigan; and Honeywell, Inc., Hopkins, Minnesota.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: An expendable mine clearing roller was developed for Southeast Asia in 1970. A track width mine plow (TMP) was developed from a Soviet design but was terminated because of blast vulnerability. The fuel-air explosive, helicopter delivered (FAESHED) was developed and tested.
2. FY 1977 Program. Initiate engineering development of the route interdiction mine detector (RIMD) and the hybrid mine clearing roller.
3. FY 1978 Planned Program: Conduct Developmental Testing II (DT II/OT II) on the RIMD. Complete testing and type classify the mine clearing roller. Decrease in funding required reflects the move of Surface Launched Unit, Fuel-Air Explosive (SLUFAE) to Project #D145.
4. FY 1979 Planned Program: Initiate engineering development of the man portable mine neutralizer (MANPLEX) and close-in mine neutralizer (SPRAYFAE). Initiate chemical neutralization of explosives (CHENS). Complete DT II/OT II on the RIMD. Increased funding reflects initiation of MANPLEX, SPRAYFAE, and CHENS.
5. Program to Completion: This is a continuing program.

Budget Activity #4 - Tactical Programs

Program Element #6.46.12.A

Project #D415

RESOURCES: (\$ in Thousands)

Title Countermine and Barriers

Title Mine Neutral/Detection

|             | <u>FY 1976</u>                                   | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional<br/>to<br/>Completion</u> | <u>Total<br/>Estimated<br/>Cost</u> |
|-------------|--|----------------|----------------|----------------|---|-------------------------------------|
| RDTE: Funds | 2335   | 5298           | 2421           | 3271           | Continuing                              | Not Applicable                      |
| Quantities  | Includes a number of individual test components. |                |                |                |   |                                     |



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.12.A

Title Countermine and Barriers

Project #D556

Title Surface Launched Unit, Mine Rocket (SLUMINE)

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The Surface Launched Unit, Mine Rocket (SLUMINE) utilizes the Surface Launched Unit, Fuel-Air Explosive (SLUFAE) launcher to deliver a high density of scatterable mines out to five kilometers in 90 seconds. Provides a dual capability to the SLUFAE launcher.

RELATED ACTIVITIES: The project follows from advanced development Program Element 6.36.19.A, Countermine and Barriers during which optimum minefield patterns and rocket configuration will be determined. The mines used in SLUMINE are derived from the components of the family of scatterable mine (FASCAM) developed in P. E. 6.46.19.A.

WORK PERFORMED BY: The principal Army agency for SLUMINE is the US Army Mobility Equipment Research and Development Command, Fort Belvoir, Virginia. Other government agencies providing support are: US Army Missile Research and Development Command (MIRADCOM), Huntsville, Alabama; Naval Weapons Center, China Lake, California; Naval Surface Weapons Center, Silver Spring, Maryland; Project Manager for Selected Ammunition, Dover, New Jersey; and the US Army Test and Evaluation, Aberdeen, Maryland. The principal contractors are Lanson Industries, Inc., Cullman, Alabama; Honeywell, Inc., Hopkins, Minnesota; and Hughes Aircraft Company, Fullerton, California.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: SLUMINE evolves from the SLUFAE work in P. E. 6.46.12.A and the FASCAM work in P. E. 6.46.19.A. SLUMINE is a new project.
2. FY 1977 Program: SLUMINE starts advanced development in FY 1978.
3. FY 1978 Planned Program: SLUMINE is programmed for advanced development. Funds for advanced development are programmed in P. E. 6.36.19.A, Countermine and Barriers.
4. FY 1979 Planned Program: System scheduled to enter engineering development. Procure hardware for Developmental Testing II/Operational Testing II (DT II/OT II). Increase in funds required to initiate engineering development. All necessary experimental work has been performed and proposed system is ready for full scale development.
5. Program to Completion: Conduct DT II/OT II testing in FY 1980 and FY 1981. Type classify SLUMINE in FY 1982.

Budget Activity #4 - Tactical Programs

Program Element #6.46.12.A

Project #D556

6. Major Milestones:

Title Countermine and Barriers

Title Surface Launched Unit, Mine Rocket (SLUMINE)

Estimated RDTE Cost to  
Reach Events (Cumulative)

Date

a. Type Classification

b. Production Validation In-Process Review

RESOURCES: (\$ in Thousands)

FY 1981

FY 1982

17000

18000

Additional  
to  
Completion  
Estimated  
Cost

FY 1979

FY 1978

FY 1977

FY 1976

0

0

0

0

0

5400

0

0

0

0

0

0

0

0

0

Includes a number of individual test components.

12600

18000

RDTE: Funds  
Quantities

Procurement:

Funds  
Quantities

To be Determined  
To be Determined

0

0

0

0

0

0

0

0

0

0

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.13.A

Title Incapacitating Chemical Munitions

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES / PROJECT LISTING/ (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|-------------------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 0       | 0       | 0       | 1514    |                                     | Not Applicable       |

|      |                                   |   |   |   |      |            |                |
|------|-----------------------------------|---|---|---|------|------------|----------------|
| DF90 | Incapacitating Chemical Munitions | 0 | 0 | 0 | 1514 | Continuing | Not Applicable |
|------|-----------------------------------|---|---|---|------|------------|----------------|

BRIEF DESCRIPTION OF ELEMENT: This program supports the development of new incapacitating agent munitions and equipment.

BASIS FOR FY 1978 RDTE REQUEST: Not Applicable.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Not Applicable.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 0    | 0           | 0     |
| (2) Contractor Employees   | 0    | 0           | 0     |
| Total                      | 0    | 0           | 0     |

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to conduct engineering development on non-lethal incapacitating agent munitions which have advanced through advanced development and have shown sufficient potential for casualty production through the respiratory and/or percutaneous routes. Production concepts and requirements are investigated to form the basis for future production facilities.

Budget Activity #4 - Tactical Programs

Program Element #6.46.13.A

Title Incapacitating Chemical Munitions

RELATED ACTIVITIES: No comparable work is done by other Services on incapacitating agent processes. Each Service carries out engineering development of chemical weapons unique to its requirements. Information is exchanged and the efforts are coordinated through exchange of documents, liaison officers and by joint technical coordinating groups.

WORK PERFORMED BY: US Army Armament Research and Development Command, Dover, NJ and US Army Test and Evaluation Command, Aberdeen, MD.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Not Applicable.
2. FY 1977 Program: Not Applicable.
3. FY 1978 Planned Program: Not Applicable.
4. FY 1979 Planned Program: Assuming the present suspended advanced development program for the XM723 155mm Incapacitating Agent Projectile is reinstated and that advanced development for an air delivered incapacitating agent weapon is established and funded, engineering development programs, including procurement of necessary hardware, will be initiated in FY 79. All necessary experimental work has been performed and the proposed system is ready for full scale development.
5. Program to Completion: This is a continuing program.

FY 1978 RDTE DESCRIPTIVE SUMMARY:

Program Element #6.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title  | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion Continuing | Total Estimated Cost Not Applicable |
|----------------|--|---------|---------|---------|---------|-------------------------------------|-------------------------------------|
|                | TOTAL FOR PROGRAM ELEMENT  | 3858    | 5326    | 5105    | 5119    |                                     |                                     |
|                | Quantities (Not feasible to list due to number of diverse items) |         |         |         |         |                                     |                                     |

|      |                               |      |      |      |      |            |                |
|------|-------------------------------|------|------|------|------|------------|----------------|
| D373 | Ammunition Cannon, 155mm      | 1506 | 5326 | 3725 | 5119 | Continuing | Not Applicable |
| D379 | Howitzer, Medium, 155mm XM198 | 2352 | 0    | 1380 | 0    | Continuing | Not Applicable |

BRIEF DESCRIPTION OF ELEMENT: The purpose of this program is to develop weapons and ammunition providing increased lethality, accuracy, range, reliability and speed in delivering fires.

BASIS FOR FY 1978 RDTE REQUEST: To provide for: development of two new 155mm propelling charges; a new 155mm high explosive projectile; a new 155mm smoke projectile; to conduct Development Test III on the production models of the Howitzer, Medium, Towed, 155mm, M198, and to complete compatibility testing with the M198 and the M454, 155mm, nuclear projectile.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Engineering development of the propelling charges is nearing completion. The first nineteen M198 howitzers will have been produced which will undergo Development Test III, Operational Test III, and continued ammunition compatibility testing.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                           | RDTE | PROCUREMENT | TOTAL |
|---------------------------|------|-------------|-------|
| (1) Federal Civ Employees | 72   | 0           | 72    |
| (2) Contractor Employees  | 0    | 0           | 0     |
| Total                     | 72   | 0           | 72    |



Budget Activity #4 - Tactical Programs

Program Element #6.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

DETAILED BACKGROUND AND DESCRIPTION: The program consists of two active programs covering development of 155mm weapons and ammunition. This provides for the development of the XM211 low zone propelling charge, the XM201 intermediate zone propelling charge, the XM795 high explosive projectile and the XM761 White Phosphorous smoke projectile. These items will provide significantly increased firepower to the US Army. The objective of the M198 program is to develop a 155mm towed howitzer that will meet the requirement for towed, medium artillery with a range of 30,000 meters. This increased range will enable our medium artillery to be competitive with and survivable against the present Soviet 130mm field gun M-46 (77,000) meters and will enhance the capability to mass fires. The present 155mm towed howitzer, M114A1, being replaced by the M198, has a range of only 14,600 meters. It was initially fielded in 1942 and is nearing the end of its useful life. The M198's transportable by the CH-47C helicopter.

RELATED ACTIVITIES: This program is the normal engineering development program for advanced development that has been in Program Element 6.36.28.A, Field Artillery Weapon and Ammunition, and dependent upon technology developed under Program Element 6.26.03, Large Caliber and Nuclear Technology. The US Marine Corps has stated an interest in the M198 and is monitoring development progress. Cooperative agreements exist with NATO nations on the characteristics of 155mm howitzers to include the requirement for ammunition interchangeability. A letter of offer of loan of an M198 Development Prototype was made to the Government of Australia in October 1974 and a Memorandum of Understanding, covering this loan, was prepared for submission to the Government of Australia in early 1975.

WORK PERFORMED BY: US Army Armament Research and Development Command at Rock Island, IL; Dover, NJ; Aberdeen, MD; and Yuma Proving Ground, Yuma, AZ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The XM203 high zone propelling charge completed engineering development and was approved for type classification standard. The shape of the XM795 projectile was changed to be ballistically similar to the cargo optimized family of projectiles. The XM164 low zone propelling charge was redesigned to eliminate stickers at low zones and was redesignated as the XM211 charge.

a. Concept formulation for the M198 was completed in FY 1973. An advanced development prototype was fabricated and tested. Approximately 1,000 rounds were fired in advanced development. Engineering development prototypes one and two were manufactured and underwent an extensive engineering development (ED) test program to evaluate such factors as reliability, durability, human factors compatibility, range, precision, cannon fatigue life, transportability, environmental extremes and towing. Durability problems encountered during firing tests on the first two prototypes led to a decision to conduct a full 15,000 round test on prototype three before Development Test (DT)/Operational Test (OT) II. This caused a nine month slip in the program. Numerous design improvements were incorporated into prototype three which commenced testing in March 1973. Prototype three was severely damaged

Budget Activity #4 - Tactical Programs

Program Element #6.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

when excessive chamber pressure caused a breech block blowout. The breech block blowout on prototype three resulted in an additional four months slippage plus a realignment of the M198 program to utilize a total of nine engineering prototypes instead of the originally planned ten. Immediate steps were taken to rebuild the prototype and the 15,000 round durability test was rescheduled for FY 1974.

b. Rebuild of prototype three was completed in August 1973 and the first phase durability test began at Camp McCoy, Wisconsin, in early September 1973 and was completed 31 October 1973. During the first phase, the M198 was towed 1,000 miles. The second phase of the durability test began at Jefferson Proving Ground, Madison, Indiana, in December 1973 and the total durability test was completed in August 1974. As of 12 August 1974, a total of 15,000 rounds had been fired on prototype three and the system had been towed 5,000 miles. Demonstrated Mean Round Between Failure was 612 rounds which exceeded the prediction at the completion of Development Test (DT)/Operational Test (OT) II.

c. The prototype three weapon was shipped to Fort Sill, Oklahoma, for examination and evaluation. Two problems with the hydraulic system were encountered and some design changes to facilitate obturator assembly, illuminate the panel, provide a nitrogen pressure gage and reduce spade weight were requested. The design of the DT/OT II prototype weapons was frozen 30 June 1974. Design changes were limited to those necessary to correct deficiencies. The six additional prototypes required for DT/OT II testing were completed and delivered to their respective test sites during the third quarter FY 1975. The cannon fatigue test was completed in February 1975 and the ammunition safety test was completed in July 1975. All phases of DT/OT II testing phases of the M198 were initiated in FY 1975.

d. An Army Systems Acquisition Review Council III (ASARC III) convened on 14 October 1976 and approved the XM198 for type classification standard and to enter production. Environmental testing was initiated in fourth quarter FY 1976 with one prototype shipped to Australia for tropic testing.

2. FY 1977 Program: The XM201 propelling charge will undergo further tube wear tests, and firing table testing, and will be type classified in the fourth quarter. The XM211 propelling charge is being tested to determine propensity for stickers at low zones. Engineering development will continue on the high explosive projectile. M198 arctic testing will be accomplished at Fort Greely, Alaska, during second quarter FY 1977 with the tropic test being completed during third quarter FY 1977. The FY 1976 procurement of 19 M198s and the FY 1977 procurement of 51 M198s will be initiated with first deliveries for test made in fourth quarter FY 1978.

3. FY 1978 Planned Program: Engineering tests of the XM211 propelling charge will be completed. Tests of the high explosive projectile and WP smoke projectile will continue. Development Test (DT)/Operational Test (OT) III will be conducted during fourth quarter FY 1978 and continuing through second quarter FY 1979. M454 nuclear compatibility testing will be completed. The FY 1978 procurement of 148 M198s will be executed. Funding is decreased since the XM201 propelling charge development was completed.

Budget Activity #4 - Tactical Programs

Program Element #6.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

4. FY 1979 Planned Program: Development testing II and operational testing II of the XM211 propelling charge and the XM795 high explosive projectile will be completed and type classified. DT III and OT III will be completed on the M198. Full production will be initiated during FY 1978. FY 1979 will be the fourth year of a planned five-year production.

5. Program to Completion: This is a continuing program.

Budget Activity #4 - Tactical Programs

Program Element #6.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

XM198 155mm howitzer is an in-house development of US Army Armament Research and Development Command (ARRADCOM), Rock Island, IL, and is managed by Project Manager, Cannon Artillery Weapons Systems. ARRADCOM, Dover, NJ, is supporting the program with ammunition development.

The XM198 is a towed field artillery howitzer and is air transportable by CH-47 helicopter. This weapon was developed to provide an increase in range and improved reliability and maintainability over the standard towed M114 and M114A1 towed 155mm howitzer now in use in the US Army. The XM198 will be employed in the general support field artillery battalions of the Infantry and air assault divisions and in corps artillery.

The XM198 is scheduled to complete final subtests of Development Test II (DT II) in July 1977. DT III and Operational Test (OT) III are now scheduled to be conducted separately from August 1978 through January 1979. DT III will subject the initial production howitzers to a 15,100 rounds firing test and 4,800 miles of mobility testing.

Development test (DT) and evaluation began in December 1968 with advanced development (AD) and initial engineering development (ED) test. These tests essentially equate to the current DT I. AD testing provided a basis for the design and fabrication of three ED prototypes delivered for testing in 1970. Two of these weapons were subjected to firing tests at ARRADCOM, Aberdeen, Maryland and Yuma Proving Ground (YPG), Arizona. After firing 10,000 rounds, durability problems were identified. The breech designed was changed from a sliding block to an interrupted screw block to improve durability. A third prototype was subjected to a 15,000 round durability firing test at Camp McCoy, Wisconsin, in March 1973. The 44th round produced a propelling charge malfunction which damaged the weapon. As a result of this incident, the XM203 propelling charge was redesigned. During ammunition safety tests in December 1975, a breach was blown from the XM199 cannon (barrel and breech assemblies) installed in a proof mount while firing the XM203 propelling charge. The charge igniter pad was redesigned resulting in the current XM203E2 designation. DT II has been extended through July 1977; subtests to be completed include the arctic and tropic climatic tests, ammunition safety and verification of firing tables tests. Except for design changes noted, ED prototypes are similar to the item to be procured. Several deficiencies were identified during DT II:

(1) Tube wear has prevented the attainment of the 2500 effective full charge (EFC) round tube life. In view of the current technological state-of-the-art and the quantum increase in range capability attained by the XM203 this charge has been accepted with 1750 rounds per tube life. However, a technological program has been initiated with the objective of improving cannon tube life. Currently, bore plating, stick propellants, and propellant additives are being investigated.

(2) Vulnerability of the XM198 was considered a problem during DT II. Modifications to the equilibrator and recoil mechanism have reduced the vulnerability of the weapon to a level lower than that experienced by crew in foxholes but slightly higher than the M114A1.



Budget Activity #4 - Tactical Programs

Program Element #6.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

(3) Ammunition performance and compatibility problems were also identified in several areas.

- (a) The XM203 charge was redesigned to prevent excessive pressures and for compatibility with the M549 rock assisted projectile.
- (b) Sticking (projectiles remaining in the bore) has been experienced when firing current standard low zone propelling charges and the developmental XM164 low zone propelling charge. The XM164 was designed as a replacement for the current low zone charges and as the XM211. Preliminary test results of this program are encouraging and indicate sticking will be eliminated.
- (c) The intermediate propelling charge XM201 has produced excessive tube wear. Modification to the charge seems to have eliminated this problem.
- (d) The current 155mm nuclear projectile, M454, has not been certified in the XM198 howitzer. Interior dimensions of the XM199 cannon are similar to the M185 cannon of the M109A1 howitzer. The M454 is compatible with the M109A1, therefore it is technically compatible in the XM198. M454 and M199 compatibility testing is scheduled for FY 77 and FY 78.

The XM198 has met all requirements for reliability and maintainability criteria other than tube life as noted. The weapon has not met the required operational availability requirements. The current administrative and logistic downtimes (ALDT) used to compute operational availability are such that the XM198 may not meet the requirement. The ALDT criteria are being reviewed for possible revision.

DT III testing will be conducted using low range initial production (LRIP) weapons. DT III is planned as a reliability/durability test (15,000 EPC rounds) of one production weapon against Reliability, Availability, Maintainability-Durability (RAM-D) requirements. Another durability test is planned when carriage manufacture is shifted to industry at the start of full production. Critical issues for DT III are safety and RAM-D of production weapons. DT III is to be conducted between August 1978 and February 1979.

2. Operational Test and Evaluation:

The Field Artillery Board evaluated human engineering aspects and operational suitability of the XM198 at Fort Sill, OK, during the period 2-17 Aug 72 using a single weapon and crew. The consensus of the evaluation was that the XM198, with stated recommended modifications, would be capable of fulfilling its mission, and would meet operational requirements. Specifically, the XM198 demonstrated excellent towing mobility using the M656, 5 ton 8X8 truck (the M54A2, 5 ton 6X6 truck, demonstrated a lesser towing capability), experienced no significant emplacement/displacement problems, and is compatible with personnel skills and aptitudes.



Budget Activity #4 - Tactical Programs

Program Element #6.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

The US Army Field Artillery School conducted an informal user evaluation of the Engineering Development prototype. The objective was to evaluate operational performance and the training required to prepare experienced troops to operate the XM198. The School concluded that the crew could readily perform their assigned duties. Malfunctions of the hydraulic pump and actuator assembly were experienced.

Operational Test II (OT II), a battery level, side-by-side comparison test was conducted by the US Army Operational Test and Evaluation Agency (OTEA) at Fort Sill, Oklahoma, from July to December 1975. Three XM198s and three M114As were tested concurrently in four phases: new equipment training; reliability, availability, and maintainability (RAM-X) firing exercise; field exercise; and extended range. Issues concerning range precision, 6400 mil capability, ease and simplicity of operation, displacement with helicopter, emplacement/displacement, rapid responsiveness to fire commands, operational rates of fire, training and limited employment, doctrine, and personnel selection procedures were satisfactorily demonstrated. Issues related to accuracy and all ammunition combinations were not tested because firing tables and some projectile safety certifications were not available. Proper functioning of the traversing mechanism clutch, hydraulics and elevation mechanism must be reexamined. The RAM characteristics of production models, the maintenance burden, towing with the designated prime mover, crew protection from blast overpressure, visual signature, maximum/sustained rates of fire and deployability by C-130 are areas requiring further testing. OT III will be conducted from October 1978 to January 1979 at Fort Lewis, Washington, by OTEA.

The evaluation of OT II results and other tests indicated that acquisition of the XM198 should be delayed until command and control problems associated with double ear protection and C-130 aircraft transportability problems were solved. OTEA also stated that problems with traversing and elevating mechanisms and the hydraulic system should be corrected prior to OT III. The Project Manager had fixes developed to the hardware problems, obtained the United Kingdom hearing protection device and provided these solutions to the user for test. Concurrently HQDA request USAF assistance in solving the C-130 issue and directed The Surgeon General to develop a short and long range program to protect the soldier from the effects of blast over pressure. Based on the results of testing subsequent to OT II, Commander, OTEA, then recommended the continuation of the XM198 acquisition process. System problems were addressed by a General Officer Review on 2 August 1976. The Project Manager demonstrated to the Review Board's satisfaction that these problems were solved or solutions were at hand.

Operational Test III (OT III), October 1978-January 1979. This test is scheduled at Fort Lewis, Washington. According to current planning, six low rate initial production (LRIP) weapons plus one float weapon will be tested in a simulated tactical environment by OTEA to insure that production items duplicate the performance of engineering development prototypes and that modifications and items requiring further operational testing are examined. Specifically, RAM, maintenance support, mission performance, mobility, safety, and survivability, are key operational issues for test during OT III.

Budget Activity #4 - Tactical Programs

Program Element: #6.46.14.A

3. System Characteristics:

Operational/Technical Characteristics

Max Range (km)  
Assisted Projectiles  
Unassisted Projectiles

Precision

Range (%)  
Azimuth (mils)

Rate of Fire (rds/min)

Max (for 3 min)  
Sustained (30 min)

Durability (EFC)

Carriage  
Breech Ring

Recoil Mechanism

Tube Life (rds) (XM203, Zone 8)

Weight (lbs)  
Reliability (MRBF)  
Availability (%)

Title Field Artillery Weapons and Ammunition, 155mm

Requirement Demonstrated

28.5 30.5  
22.0 22.6

.3 .22  
1 1

4 4  
1 1

15,000 15,000  
7,500 15,000

10,000 15,000  
2,500 1,750 1/  
15,000 15,250

700 877  
83 67.3 OT II 2/  
89.8 DT II

- 1/ User accepts 1750 rd tube life with XM203, but desires improved tube life through tube wear technology program and investigation of stick propellant.
- 2/ Variance in OT to DT data is a result of the criteria set for the Administrative Logistical Down Time and the maintenance allocation concept. These items are under revision and the Ao may then be increased.
- 3/ The M198 howitzer and the M203 propelling charge were type classified; standard, Logistical Control Code A, on 3 December 1976 by HQDA.

FY 1978 ROUTE DESCRIPTIVE SUMMARY

Program Element #6.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

Project #D373

Title Ammunition, Cannon, 155mm

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The purpose of this project is to conduct engineering development on ammunition components for 155mm howitzers. The XM211 and XM201 propelling charges will replace the M3, M4, and M19 charges. They will be type classified for use in both the XM198 and M109A1 howitzers. The XM203 (Zone 8) will be type classified with the XM198 howitzer and is being tested for compatibility with the M109A1 howitzer. The XM795 High Explosive (HE) projectile is being developed as a replacement for the standard M107 projectile and will be ballistically similar to the cargo optimized family (M483A1, XM761 smoke, M692/XM718 Mines). The XM761 white phosphorous projectile will replace the current smoke projectile and will provide a significantly longer lasting source of screening smoke.

RELATED ACTIVITIES: The development of new munitions for 155mm howitzers is a continuation of advanced development efforts funded under Program Element 6.36.28.A, Field Artillery Weapons & Ammunition Development.

WORK PERFORMED BY: Project Manager for Cannon Artillery Weapon Systems, US Army Armament Research & Development Command (ARRADCOM), Dover, NJ; ARRADCOM, Edgewood, MD; and Army Materiel Systems Analysis Agency Aberdeen Md.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Engineering development was initiated for a new family (XM614, XM201, XM203) of 155mm propelling charges for the 155mm howitzer XM198 and M109A1. Development was completed on the M549 rocket assisted projectile (RAP). The XM164 propelling charge produced low zone stickers and was redesigned to eliminate stickers. It was redesignated as the XM211 charge. Development of the XM203 propelling charge was completed. The XM201 propelling charge was certified with the M109A1 howitzer but was not type classified due to excessive tube wear. A minor change was made in the charge, and tube wear testing has successfully demonstrated significantly increased tube life. The XM708 high explosive (HE) range optimized projectile development was terminated, and advanced development of the XM795 HE cargo optimized projectile was initiated. The XM761 smoke projectile exhibited instability in flight and reentered advanced development.
2. FY 1977 Program: The XM203 propelling charge will be type classified. Development of the XM211 propelling charge will continue. Complete engineering testing and development testing of the XM201 propelling charge and type classify the charge. Develop firing tables for the XM201 charge in the M109A1 and XM198 howitzers. Continue development of the XM795 HE projectile.

Budget Activity #4 - Tactical Programs

Program Element #5.46.14.A

Title Field Artillery Weapons and Ammunition, 155mm

Project #D373

Title Ammunition, Cannon, 155mm

3. FY 1978 Planned Program: Complete development of the XM211 propelling charge, and type classify the charge for use in the XM198 howitzer and the M109A1 howitzer. Initiate engineering development of the XM795 projectile and complete the XM203 charge compatibility testing with the M109A1 howitzer. Funding is decreased as two projects are completed.
4. FY 1979 Planned Program: Type classify the XM211 propelling charge. Initiate engineering development of the XM761 smoke projectile which will require increased funding above the FY 1978 level. Conduct safety tests, cold weather tests, and ballistic match tests on the XM795 projectile.

5. Program to Completion: This is a continuing program.

RESOURCES: (\$ in Thousands)

|                        | <u>FY 1976</u>  | <u>FY 1977</u> | <u>FY 1978</u> | <u>FY 1979</u> | <u>Additional to Completion</u> | <u>Total Estimated Cost</u> |
|------------------------|---|----------------|----------------|----------------|---------------------------------|-----------------------------|
| RDTE: Funds            | 1506  | 450            | 5326           | 5119           | Continuing                      | Not Applicable              |
| Quantities             | (Not feasible to list due to number of diverse items) |                | 3725           |                |                                 |                             |
| Procurement:           |   |                |                |                |                                 |                             |
| Funds                  | 0   | 0              | 17700          | 60800          | Continuing                      | Not Applicable              |
| Quantities (thousands) |   |                | 35300          |                |                                 |                             |
| XM201                  | 0   | 0              | 0              | 581            | Continuing                      | Not Applicable              |
| XM203                  | 0   | 0              | 240            | 298            | Continuing                      | Not Applicable              |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.15.A

Title Tank Thermal Sight

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 5713    | 2600    | 8223    | 2451    | 0                        | 29370                |
| DE25           | Tank Thermal Sight                   | 5713    | 2600    | 8223    | 2451    | 0                        | 29370                |

**BRIEF DESCRIPTION OF ELEMENT:** Development of a thermal sight for the M60A3 tank and a family of modules for use in other combat vehicles. Thermal sights use advanced far-infrared technology to image heat emitted from objects. They are completely passive, penetrate smoke and some haze, operate in any light level, and are difficult to countermeasure.

**BASIS FOR FY 1978 RDTE REQUEST:** Completion of Development Test/Operational Test II (DT/OT II) of engineering development and low rate initial production (LRIP) models and completion of production engineering planning (PEP). Completes RDTE for this item.

**BASIS FOR CHANGE IN FY 1978 OVER FY 1977:** Since this is last year of RDTE funding, it is necessary only to complete planning for production, testing, and transition into full scale production.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL | FY 1977 and Prior | FY 1978 | Total |
|----------------------------|------|-------------|-------|-------------------|---------|-------|
| (1) Federal Civ. Employees | 8    | 0           | 8     |                   |         |       |
| (2) Contractor Employees   | 22   | 0           | 22    |                   |         |       |
| Total                      | 30   | 0           | 30    | 26927             | 17620   | 26927 |
|                            |      |             |       |                   |         | 17620 |

(1) Estimated Government Liability Financed with:  
RDTE  
Procurement

TERMINATION COST: (\$ in Thousands)



Budget Activity #4 - Tactical Programs

Program Element #6.46.15.A

Title Tank Thermal Sight

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop a thermal sight for use in the current and future main battle tanks. The sight will be mounted entirely inside the tank turret, will be integrated fully into the tank's fire control system, and will provide the tank crew an improved capability of detecting, identifying and engaging targets at night when there is no ambient light and during the day where the target is obscured by weather, smoke, or dust. The sight will be entirely passive; therefore, it will not be subject to detection by the enemy by means of normal vision devices.

RELATED ACTIVITIES: This program was funded in FY 1973 under Program Element (PE) 6.46.04.A, M60A1 Tank Product Improvement Program. This program is being coordinated with related thermal imaging efforts being conducted under PE 6.37.17.A, Surveillance, Target Acquisition, and Night Observation. Duplication between Services is avoided by using the Army's Night Vision Laboratory which is the Joint Configuration Manager for all thermal imaging systems for all Services.

WORK PERFORMED BY: The in-house work is being performed by Project Manager for M60 Tanks (Development), Warren, MI; US Army Electronics Research and Development Command, Night Vision Laboratory, Ft. Belvoir, A, and US Army Test and Evaluation Command, Aberdeen, MD. Primary contractors are Texas Instruments, Incorporated, Dallas, TX and Chrysler Corporation, Centerline, MI.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: A prototype thermal sight was fabricated by Hughes Aircraft Company and was delivered to the Army in April 1973. This prototype began competitive testing with another thermal sight prototype delivered by Chrysler Corporation/Texas Instruments, Inc. under PE 6.37.19. Testing was completed in September 1973. It was determined that improvement in the areas of sensitivity, resolution, and display were required in each of the thermal sight prototypes. A decision was made not to enter engineering development as originally planned but to upgrade the current effort by continuing advanced development for another year. To this end, a contract was awarded to two contractors in June and July 1974. Each contractor was required to provide two prototypes for testing. In FY 1975 each contractor developed a prototype thermal sight and delivered two systems (one in vehicle plus one spare) in early July 1975 to undergo Developmental Test I/Operational Test I (DT I/OT I) in FY 1976. After delivery to the Night Vision Laboratory (NVL) for laboratory check-out, the prototype systems were provided to Chrysler Defense Engineering (CDE) for integration into test tank. This was done at Aberdeen Proving Ground where competitive DT I/OT I was completed from September-December 1975. Test results were very favorable and a validation In-Process Review (IPR) was conducted on 6 May 1976. An engineering development (ED) contract was awarded to the winning contractor, Texas Instruments, to commence development of 16 thermal sight systems and spare parts for delivery beginning March 1977. The contract includes an option to begin Low Rate Initial Production (LRIP) of 300 systems. Producibility, Engineering and Planning (PEP) was initiated in FY 1976. Test bed tanks and their fire control systems were refurbished prior to the integration of prototypes for contractor qualification testing.

Budget Activity #4 - Tactical Programs

Program Element #6.46.15.A

Title Tank Thermal Sight

2. FY 1977 Program: Engineering Development (ED) will continue with contractor qualification testing, delivery of prototype hardware, laboratory check-out, and integration of prototype into test beds. Development Test II/Operational Test II (DT II/OT II) is scheduled to commence in July 1977. Technical Data Package (TDP) will be completed for full scale competitive production in January 1978.

3. FY 1978 Planned Program: Upon completion of ED a Development Acceptance In-Process Review (DEVA IPR) will be conducted in March 1978 to make a production decision. Final actions will be to incorporate engineering changes resulting from DT II/OT II into TDP, conduct necessary retests, and finalize producibility, Engineering and Planning (PEP) which will complete RDTE program. Full scale competitive production contract award is scheduled for mid-FY 1979.

4. FY 1979 Planned Program: Not Applicable.

5. Program to Completion: Not Applicable.

6. Major Milestones:

| Complete DT I/OT I   | Date   | Estimated RDTE Cost to Reach Events (Cumulative) |
|----------------------|--------|--|
| Enter ED             | Dec 75 | 6500   |
| First Production     | Mar 76 | 14800  |
| Complete DT II/OT II | Nov 77 | 26800  |
|                      | Feb 78 | 29370  |

Program Element #6.46.16.A  
 Category Engineering Development  
 FY 1978 RPTF DESCRIPTIVE SUMMARY  
 Title Mechanized Infantry Combat Vehicle (MICV), XM723  
 Budget Activity #4 Tactical Programs

RESOURCES [PROJECT LISTING]: (\$ in Thousands)

| Project Number | Title                     | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT | 18,915  | 3,038   | 25,251  | 15,523  | 453                      | 135,941 1/           |
|                | Quantities                |         |         |         |         |                          |                      |
|                | MICV                      | 7       | 0       | 0       | 0       | 0                        | 13                   |
|                | Firing Port Weapon - MICV | 90      | 0       | 0       | 0       | 0                        | 90                   |
|                | Weapon Station - Trainer  | 0       | 0       | 0       | 0       | 5                        | 5                    |
| D258           | MICV, XM723               | 18,515  | 2,917   | 25,251  | 15,523  | 453 2/                   | 134,651 2/ 3/        |
| D460           | Firing Port Weapon - MICV | 400     | 121     | 0       | 0       | 0                        | 1,290 4/             |
| Procurement:   |                           |         |         |         |         |                          |                      |
|                | MICV - Funds              | 0       | 0       | 64,200  | 57,000  | 995,600 2/               | 1,117,200 2/         |
|                | Quantity                  | 0       | 0       | 107     | 143     | 2,912                    | 3,162                |
|                | Firing Port Weapon - MICV |         |         |         |         |                          |                      |
|                | Funds                     | 0       | 0       | 1,834   | 0       | 6,200                    | 8,034                |
|                | Quantity                  | 0       | 0       | 3,168   | 0       | 15,804                   | 18,972               |
|                | Weapon Station Trainer    |         |         |         |         |                          |                      |
|                | Funds                     | 0       | 0       | 400     | 0       | 4,400                    | 4,800                |
|                | Quantity                  | 0       | 0       | 0       | 0       | 46                       | 46                   |

- 1/ Includes FY 1975 and Prior Year Cost.  
 2/ MICV program was reoriented to include the TOW/BUSHMASTER Armored Turret II after submission of the budget proposal. Outyear funding will require further refinement.  
 3/ Includes \$42,226,000 of FY 1975 and Prior Year Funds.  
 4/ Includes \$469,000 of FY 1975 funding.

Budget Activity #4 Tactical Programs

Program Element #6.46.16.A Title Mechanized Infantry Combat Vehicle (MICV), XM723

**BRIEF DESCRIPTION OF ELEMENT:** This program element (PE) will develop the Mechanized Infantry Combat Vehicle (MICV), XM723. The MICV will be a lightly armored, full tracked, fighting vehicle for the mechanized infantry. It will provide increased mobility and protection, and a mounted fighting capability to the infantry. The vehicle has an inherent swimming capability, and is air transportable in C-41 and C-5A aircraft. The vehicle's design will permit the mounting and employment of the Vehicle Rapid Fire Weapon System - Successor (BUSHMASTER) as its primary armament system and will incorporate the TOW missile system in an under armor configuration. Within this PE, the Firing Port Weapon (FPW) for the MICV and the weapon station trainer are also developed.

**BASIS FOR FY 1978 RDTE REQUEST:** Contract developmental effort continues to integrate the 25mm main armament system and TOW launcher system into a two man weapon station TOW/BUSHMASTER Armored Turret II (TBAT II). This program is to be structured to provide for initial procurement of the TBAT II with FY 1980 funding. The productivity engineering and planning (PEP) program will be continued.

**BASIS FOR CHANGE IN FY 1978 OVER FY 1977:** FY 1977 funding completed the development effort for the 20mm cannon vehicle and initiation of TBAT II development. FY 1978 funding is at a lower level reflecting completion of the 20mm cannon vehicle effort and continuation of the TBAT II effort.

**PERSONNEL IMPACT:**

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL | TERMINATION COST: (\$ in Thousands) |         |       |
|----------------------------|------|-------------|-------|-------------------------------------|---------|-------|
|                            |      |             |       | FY 1977 and Prior                   | FY 1978 | Total |
| (1) Federal Civ. Employees | 34   | 0           | 34    | (1) Estimated Government Liability  |         |       |
| (2) Contractor Employees   | 64   | 359         | 423   | Financed with:                      | 1225    | 97650 |
| Total                      | 98   | 359         | 457   |                                     |         |       |

**DETAILED BACKGROUND AND DESCRIPTION:** US Army doctrine for the post-1970 period requires that the option to engage in mounted combat be provided the mechanized infantry commander. To permit this, it is necessary that the infantry combat vehicle provide protection against enemy automatic weapons and also allow the infantry to fight from within the vehicle. The MICV must be compatible in mobility with the tanks of the period. The MICV is a follow-on to the M113A1 Armored Personnel Carrier (APC) and will provide improved combat effectiveness for selected mechanized infantry units. Effective with the FY 1980 procurement, the MICV will be armed with an integrated 25mm main armament system (Vehicle Rapid Fire Weapon System-BUSHMASTER) and TOW launcher system into a two-man weapon station (TBAT II).



Budget Activity #4 Tactical Programs

Program Element #6.46.16.A Title Mechanized Infantry Combat Vehicle (MICV), XM723

RELATED ACTIVITIES: Program Element (PE) 6.46.17.A, Vehicle Rapid Fire Weapon System-BUSHMASTER supports the Mechanized Infantry Combat Vehicle (MICV) program by providing the M139 20mm automatic cannon as the interim primary armament of the MICV and by developing the follow-on BUSHMASTER, a 25mm automatic cannon, to be the primary armament. The Firing Port Weapon (FPW) project was formerly funded in PE 6.36.07.A, Armv Small Arms Program. Development effort on integration of the TOW launcher into the MICV weapon station will be initiated within the Armored Cavalry Vehicle PE 6.36.25.A in FY 1977. Balance of funding to completion is programmed within the MICV PE (6.46.16.A).

WORK PERFORMED BY: The MICV engineering development is being conducted by the FMC Corporation, San Jose, CA. Major subcontractors involved in this program are General Electric, Pittsfield, MA; National Waterlift Co, Kalamazoo, MI; and the Cummins Engine Co, Columbus, IN. The contractor for the backup transmission is Detroit Diesel, Allison Division, General Motors Corporation, Indianapolis, IN. Support, as required, is being performed by the US Army Tank Automotive Research and Development Command, US Army Armament Research and Development Command, US Army Electronic Research and Development Command and US Army Missile Research and Development Command. A Project Manager has been assigned and delegated centralized management authority for the execution of this entire program.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: A special cost effectiveness study was conducted on possible alternatives to new development, including the German MARDER, and a product improved M13AL Armored Personnel Carrier (APC). The MICV program was approved by the Defense Systems Acquisition Review Council (DSARC). Following the source selection process, a cost-plus incentive-fee contract was awarded to FMC in November 1972 for Engineering Development and Advanced Production Engineering. One prototype and two test rigs were fabricated for early design testing. Technical difficulties were uncovered in the power train and suspension systems. The suspension system was fixed, but the transmission, while improving, continued to show inadequate reliability. The FPW project was transferred to this program following the Concept Formulation In-Process Review in May 1974. The Modified M16 Rifle was selected to enter engineering development (EP) as the candidate weapon. A backup transmission program was initiated with Allison in September 1975 and a contract was awarded to General Electric for a Reliability Improvement Selected Equipment program to improve transmission reliability. Prototype Qualification Test-Government (PQT-G) was initiated on 1 October 1975, only to be terminated 2 February 1976 when the testing indicated the transmission was the component with the highest degree of uncertainty; as a result, the dual transmission program was initiated with Allison. During the remainder of FY 1976, transmission problems were corrected and verified, Allison transmissions installed, General Electric transmissions updated and installed, and eight vehicles repaired as necessary for PQT-G and Operational Test (OT) II tests, which resumed October 1976. Four of the vehicles use the General Electric transmission while the other four use the Allison transmission with a final transmission decision being based on PQT-G and OT II test data. During the final quarter of FY 1976 the Army organized a special MICV Task Force to review the total MICV program and make recommendations on vehicle configuration in view of the operational requirement. This resulted in redirection from a one-man to a two-man weapon station with the inclusion of the TOW for an on-board antitank capability.



# **Budget Activity #4 Tactical Programs**

Program Element #6.46.16.A

Title Mechanized Infantry Combat Vehicle (MICV), XM723

2. FY 1977 Program: The Engineering Development (ED) Phase of the contract and the Producibility Engineering and Planning Phase (PEP) will be completed. Operational Testing (OT) II will be conducted at Fort Benning from October 1976 through January 1977. Prototype Qualification Test-Government (PQT-G) will be conducted at Aberdeen Proving Grounds in FY 1977. Both transmissions will be tested with the selection for Low Rate Initial Production (LRIP) being made during the 4th quarter FY 1977. Defense Systems Acquisition Review Council III (DSARC III) is scheduled for July 1977 to initiate LRIP in the 1st quarter FY 1978. Engineering design of the TOW/BUSHMASTER Armored Turret II (TBAT II) will be started to include initiation of integrated sight development and repackaging of the TOW missile guidance set. The ED vehicle chassis will be refurbished and modified for TBAT II. Fabrication of ED TBAT II weapon station will be initiated.

3. FY 1978 Planned Program: The LRIP contract will be awarded. Effort will be continued on the design and fabrication of ten TBAT II weapon stations, five each for the self-propelled gun and five each for the externally-powered gun. Chassis refurbishment and modification will be completed; effort will continue on the integrated sight and missile guidance set repackaging, and ED of weapon station will be completed.

4. FY 1979 Planned Program: Integrated sight and missile guidance set repackaging effort will be completed. PEP phase for TBAT II, LRIP PQT-G on TBAT II, and OT II of TBAT II will be initiated. LRIP contract will continue with first deliveries scheduled for January 1979.

5. Program to Completion: LRIP phase of the contract, begun in FY 1978, will continue. First full production vehicles are scheduled for delivery in FY 1982. The ED and PEP phases of TBAT II will be completed as will the OT II and PQT-G testing. ASARC III for the TBAT II is scheduled for January 1980 with DSARC III in February 1980.

## **6. Major Milestones: (\$ in Thousands)**

|  | Date   | Estimated ROTE Cost to Reach Events (Cumulative) |
|--|--------|--|
| a. TBAT II Development - (25mm/10W) - Start - Contract Award | Nov 76 | 63,648   |
| b. Army System Acquisition Review Council III                | Jun 77 | 85,846   |
| c. Defense System Acquisition Review Council III             | Jul 77 | 88,312   |
| d. PQT-G Tests (20mm) Complete                               | Sep 77 | 93,245   |
| e. Engineering Development (20mm) Complete                   | Sep 77 | 93,245   |
| f. Producibility Engineering & Planning (20mm) Complete      | Sep 77 | 93,245   |
| g. PQT-G of TBAT II Start                                    | Mar 79 | 128,379  |
| h. OT II - TBAT II Start                                     | Jul 79 | 132,260  |
| i. OT II - TBAT II Complete                                  | Nov 79 | 133,349  |
| j. TBAT II Development - Complete                            | Jan 80 | 134,651  |
| k. TBAT II PEP - Complete                                    | Jan 80 | 134,651  |
| l. PQT-G TBAT II - Complete                                  | Jan 80 | 134,651  |
| m. TBAT II Army System Acquisition Review Council III        | Jan 80 | 134,651  |
| n. TBAT II Defense System Acquisition Review Council III     | Feb 80 | 134,651  |

Budget Activity #4 Tactical Programs

Program Element #6.46.16.A

Title Mechanized Infantry Combat Vehicle (MICV), XN701

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. Contractor - FMC Corporation, San Jose, California.

b. The Mechanized Infantry Combat Vehicle (MICV) entered engineering development without undergoing Development Test I (DT I) or Operational Test I (OT I) because the extensive effort since 1964 on the MICV program assured program worth and readiness to warrant commitment of resources to full scale development in accordance with policy established in DOD Directive 5000.1. This concept validation effort included hardware development and testing such as: (a) test of six XM701 (MICV-65) prototype vehicles; (b) testing of four different weapon station stabilization systems; (c) hull mockups and firing tests against different thicknesses and materials of armor plate; (d) testing of various engine and transmission candidates; (e) development and prototype testing of a suspension prototype designed to provide the hypermobility characteristics required; and (f) testing of various other subsystems such as night vision periscopes, auxiliary water propulsion devices, gun systems both in the stabilized weapon platform and through vehicle firing ports. The results of these evaluations allowed establishment of firm requirements regarding wheels vs track; size of crew, weapon, and vehicle; stabilization; weight, and other characteristics.

c. Prototype Qualification Test-Government (PQT-G) (Development Test II) officially started 1 October 1975 with vehicles at Aberdeen Proving Ground (APC) and Yuma Proving Ground (YPG). PQT-G was initiated in October 1975, however due to the lack of improved performance by the transmission, testing was terminated at the end of January 1976. Contingency plans for corrective action were initiated on 2 February 1976. PQT-G was restarted on 4 October 1976 and will continue through September 1977. Testing is being accomplished by US Army Test and Evaluation Command (TECOM) using civilian technicians and test center military personnel. The conduct of individual tests has been arranged to ensure test results will be available for use in the Army Systems Acquisition Review Council III (ASARC III) and Defense Systems Acquisition Review Council III (DSARC III) decision process leading to Low Rate Initial Production (LRIP).

d. Production Validation Test-Government (PVT-G) (DT III) is scheduled to begin July 1979 and be completed in February 1980. PVT-G will be conducted by TECOM at APC and YPG using civilian technicians and test center military personnel.

2. Operational Test and Evaluation:

a. The MICV is in full engineering development without having undergone Operational Test I (OT I). See para 1b above for the rationale behind this action.

b. An Operational Climatic Test/Force Development Test and Experimentation (OCT/FDTE) was conducted during January-March 1976. The test was conducted at Fort Knox, KY using US Army Forces Command (FORSCOM) troops as player participants. The OCT provided limited data on capabilities, limitations, and safety aspects of the MICV System in European winter thaw conditions. The FDTE de-

Budget Activity #4 Tactical Programs

Program Element #6.46.16.A

Title Mechanized Infantry Combat Vehicle (MICV), XM723

veloped mobility/movement rate data on MICV. Operational Test II (OT II) started 4 October 1976 and will be completed in January 1977 prior to the decision to enter Low Rate Initial Production (LRIP). OT II is being conducted by the US Army Operational Test and Evaluation Agency (OTEA) at Fort Benning, GA using mechanized infantry troops as player participants. The test vehicles are armed with the M139 20mm automatic cannon as the interim main armament pending production of the Vehicle Rapid Fire Weapons System Successor (VRFWS-S).

c. OT III of the MICV with the 20mm interim armament system is scheduled to start in October 1979 and be completed in April 1980 before entering full production. OT III will be conducted by OTEA using US Army Forces Command troops. Unit and test site are to be determined.

3. System Characteristics:

Operational/Technical Characteristics

Maximum Speed (mph)  
Cruising Range (miles)  
Acceleration 0-30 mph (sec)  
Stabilization Accuracy on a 4 mil target (% time on target)  
Single Shot Accuracy to 1000 meters (rd to rd std dev)  
Armor Protection  
Frontal  
Side, Rear

Objectives

40-45  
300-350  
18-22

Demonstrated Performance 1/

1/ To be determined at PQT-G/OT II.

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.46.17.A Title Vehicle Rapid Fire Weapon System - BUSHMASTER

Category Engineering Development Budget Activity #4 - Tactical Programs

RESOURCES [PROJECT LISTING]: (\$ in Thousands)

| Project Number | Title                           | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|---------------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT       | 10,000  | 20,169  | 12,237  | 6,111   | 0                        | 78,793               |
|                | Quantities                      |         |         |         |         |                          | 36                   |
| D340           | VRFWS - BUSHMASTER              | 10,000  | 20,169  | 12,237  | 6,111   | 0                        | 78,793               |
| Procurement:   |                                 |         |         |         |         |                          |                      |
|                | 25mm Funds                      | 0       | 0       | 0       | 23,300  | 101,900                  | 125,200              |
|                | 25mm Quantities                 | 0       | 0       | 0       | 200     | 3,120                    | 3,320                |
|                | 20mm Product Improved (PI) M139 | 0       | 0       | 4,400   | 0       | 0                        | 4,400                |
|                | Funds                           |         |         |         |         |                          |                      |
|                | 20mm PI M139 Quantities         | 0       | 0       | 300     | 0       | 0                        | 300                  |

**BRIEF DESCRIPTION OF ELEMENT:** A 25mm automatic cannon is being developed as the primary weapon for the Mechanized Infantry Combat Vehicle (MICV). **Additionally, 25mm ammunition is being developed for this weapon. Efforts to provide the MICV with an interim weapon, the M139 Project Improved 20mm cannon, have also been conducted in this Program Element.**

**BASIS FOR FY 1978 RDT&E REQUEST:** The fourth increment of Product Engineering and Improvement of the self-powered weapon and 25mm ammunition and Engineering Development of the externally-powered weapon will be funded. The FY 1978 program will also fund for final delivery of test quantities of XM714 fuzes. The Prototype Qualification Test - Government and Operational Test II will commence during FY 1978.

Budget Activity #4 - Tactical Programs

Program Element #6.46.17.A

Title Vehicle Rapid Fire Weapon System - BUSHMASTER

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The FY 1978 program continues the work initiated in FY 1977, the peak Research and Development period for the Gun Program. Decrease in funding is attributed to transition from prototype hardware development to testing and Producibility, Engineering and Planning (PEP) in the last full year of Engineering Development (ED).

PERSONNEL IMPACT:

TERMINATION COST: (\$ in Thousands)

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement) is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |         |         |        |
|----------------------------|------|-------------|-------|---------|---------|--------|
| (1) Federal Civ. Employees | 97   | 0           | 97    | FY 1977 |         |        |
| (2) Contractor Employees   | 42   | 25          | 67    | and     |         |        |
|                            |      |             |       | Prior   | FY 1978 | Total  |
| Total                      | 139  | 25          | 164   |         | 51,500  | 954    |
|                            |      |             |       |         |         | 52,454 |

DETAILED BACKGROUND AND DESCRIPTION: The Mechanized Infantry Combat Vehicle Gun Systems (BUSHMASTER) program is for the development of a cannon to be used as primary armament on the Mechanized Infantry Combat Vehicle (MICV), XM723. This automatic cannon is intended to provide a substantial improvement over the caliber .50 machinegun and the existing 20mm M139 cannon, currently being used as armament on US lightly armored vehicles, and the M139 Product Improved (PI) which is scheduled to be used as the interim MICV gun system. The BUSHMASTER is to be developed with a capability to defeat reconnaissance and mechanized infantry combat vehicles, personnel and unarmored targets. The BUSHMASTER will be a 25mm weapon with dual feed capability that allows instantaneous selection of either armor-piercing tracer (AP-T) or high-explosive incendiary tracer (HEI-T) ammunition. The ultimate result of this program is to field an automatic cannon, either self-powered or externally-powered. The ammunition being developed has been designated as the Tri-Service 25mm ammunition and will be proposed as NATO Standard.

RELATED ACTIVITIES: The selected weapon and ammunition will be first used on the system being developed under Program Element 6.46.16, MICV, XM723. Development of the Externally Powered 25mm automatic cannon was initiated in FY 1976 under Program Element 6.36.11.A, Advanced Automatic Cannon Program D082. The Army has maintained contact with the other services and has conducted periodic Tri-Service reviews on this program. This insures a cross-fertilization of technical knowledge on developmental programs and prevents duplication of effort.



Budget Activity #4 - Tactical Programs

Program Element #6--0.17.A

Title Vehicle Rapid Fire Weapon System - BUSHMASTER

WORK PERFORMED BY: The Project Manager, MICV Systems is responsible for development of the weapon and ammunition to include the execution of all project related activities. The major contractor for the self-powered (SP) weapon is Ford Aerospace and Communications Corporation, Newport Beach, CA. The major contractor for the externally-powered (XP) weapon is Hughes Helicopters, Culver City, CA. The product improved (PI) M139 effort is accomplished in-house at US Army Armament Research and Development Command, Watervliet, NY. The XM714 fuze contractor is Honeywell, Minneapolis, MN.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: A Parametric Design/Cost Effectiveness study was conducted to establish the characteristics for the BUSHMASTER system and a qualitative material requirement was prepared based on this study. A development program based on competitive evaluation of weapon prototypes for selection of one contractor to complete development was finalized in FY 1970. A Source Selection Evaluation Board (SSEB) reviewed the proposals prior to the Government award of firm-fixed-price contracts to Ford Aerospace and Communications Corporation (25mm), General Electric (27.5mm) and Aircraft Armament Incorporated (25mm). These contractors participated in a competitive validation phase shoot-off by the US Army Test and Evaluation Command at Aberdeen Proving Ground, MD. The SSEB examined all test data and reviewed life cycle cost estimates. Army Systems Acquisition Review Council (ASARC) II held on 17 December 1974, decided that the M139 PI weapon would be used as an interim weapon for the MICV and approved initiation of engineering development (ED) of the SP weapon. As a result of Defense Systems Acquisition Review Council (DSARC) II held on 6 March 1975, the Deputy Secretary of Defense, directed that a Swiss 25mm weapon be evaluated as the baseline for the SP weapon and indicated that the M139 PI should be continued only if it was more economical. The Army also was directed to expedite the development of 25mm XP weapon and conduct a comparative evaluation with the SP weapon prior to selection of a weapon for MICV. Accordingly, the first increment of the SP product engineering and improvement contract was awarded to Ford Aerospace and Communications Corporation on 11 July 1975. A fixed price contract was awarded to the selected XP candidate, Hughes Helicopter. In the M139 PI program prototypes of dual feeders (4) and fluted barrels (2) were received during FY 1977. ED tests of weapons were conducted.
2. FY 1977 Program: SP Product Engineering and Improvement (PE&I) program and XP development program efforts will continue. SP and XP weapons will be delivered to the MICV contractor for weapon station design and fabrication efforts. Productivity Engineering and Planning (PEP) and dual feeder check tests of M139 PI program will be completed and delivery of the XM714 fuze will be delivered for high explosive ammunition government design tests. Ammunition delivery for testing will continue. Prototype Qualification Test--government (PQT-G) and Operational Test II (OT II) on ammunition will be initiated.
3. FY 1978 Planned Program: The SP PE&I program and the XP development program will be completed. The production leadtime phase of the M139 PI program will be accomplished. PEP and PQT-G Development Test (DT) II will commence on the SP and the XP programs. Fifteen of each type of weapon will be tested. MICV's mounting SP or XP weapons will be subjected to side-by-side tests. The XM714 fuze program will be completed with final delivery of fuzes for the PQT-G to the ammunition contractor. Since FY 1977 was the major funding year the FY 1978 budget is lower.

Budget Activity #4 - Tactical Programs

Program Element #6.46.17.A

Title Vehicle Rapid Fire Weapon System - BUSHMASTER

4. FY 1979 Planned Program: The Prototype Qualification Test-Government (PQT-G) Operational Test II (OT II) of the weapons and ammunition will be completed. A comparative evaluation will be conducted and the recommended system will be presented to the Army Acquisition Review Council/Defense Systems Acquisition Review Council (ASARC/DSARC) III for approval to enter Low Rate Initial Production (LRIP). FY 1979 completes the research and development phase of this program and thus this low funding level.

5. Program to Completion: The M139 PI will commence low rate initial production of dual feeders and fluted barrels. Production leadtime on the selected weapon and ammunition will begin. First production will be delivered in 3d quarter FY 1980.

6. Major Milestones:

|  | Date   | Estimated RDTE Cost to Reach Events (Cumulative) |
|--|--------|--|
| a. M139 Product Improved 20mm:   |        |  |
| Start Engineering Development (ED)   | Apr 74 | 6,911  |
| Complete ED  | Jun 76 | 7,711  |
| Complete Check Test  | Feb 77 | 8,625  |
| Complete Productability Engineering and Planning (PEP)                               | Sep 77 | 9,092  |
| b. BUSHMASTER Self-Powered; 25mm Gun & Ammunition:                                   |        |  |
| FY 1974 and Prior Year   |        | 18,939   |
| Complete Product Engineering and Improvement (PE&I)                                  | Nov 77 | 43,558   |
| Contract   |        |  |
| Complete Prototype Qualification Test - Government/Operational Test II (PQT-G/OT II) | Nov 78 | 56,352   |
| Complete PEP   | Nov 78 | 56,352   |
| c. BUSHMASTER Externally-Powered; 25mm   |        |  |
| Complete ED  | Feb 78 | 5,528 1/   |
| Complete PQT-G/OT II   | Nov 78 | 7,627  |
| Complete PEP   | Apr 79 | 10,316   |
| d. XM714A2, 25mm Fuze:   |        |  |
| Complete ED  | Jul 76 | 1,605  |
| Complete Machine Line  | Apr 77 | 4,538  |
| Complete PQT-G/OT II   | Nov 78 | 6,132  |

1/ Includes \$3,100 of Project D082, Advanced Automatic Cannon

Budget Activity - - Tactical Programs

Program Element 06, 05, 07, 08 Title Vehicle Rapid Fire Weapon System - BUSHMASTER

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: Three newly developed weapons and the standard M139 gun were subjected to an Advanced Verification Test (ADVT-G) (DT I) at US Army Test and Evaluation Command, Aberdeen, MD, from 5 March 1973 to 29 June 1973. The purpose of the test was to provide data on the performance of the ammunition and weapons under evaluation in the BUSHMASTER program, so that a selection could be made from among the contenders for further development as the vehicle rapid-fire weapon system successor. The weapons were subjected to 12 subtests, which included an initial examination; determinations of velocity, accuracy and dispersion; flame penetration and after-effects; belt-pull capacity, functioning, and high-low temperature tests; and tests with the weapon lubricated and at various attitudes. Weapon maintenance and safety were also addressed. The ammunition was subjected to ten subtests. These included an initial examination; man-barrel accuracy, time of flight, self-destruct, velocity-pressure and action time, length of trace, fuze sensitivity, fuze-arming and safe-arming, and fragmentation tests; and a safety evaluation. Five-four criteria from the system specification were used to evaluate the performance of the systems. None of the systems tested met all the criteria. Separate, detailed reports have been published for each of the four contenders. The Ford Aerospace and Communications Corporation self-powered weapon as the selected candidate. The Defense System Acquisition Review Council II (DSARC II) was held on 6 March 1975. As a result of this review the Army was directed to develop an externally-powered 25mm weapon. A comparative evaluation of the self and externally-powered weapons will be conducted prior to selection of the primary weapon for Mechanized Infantry Combat Vehicle (MICV). Prototype Qualification Test-Government (PQT-G) will commence with ammunition testing in November 1977. Weapon testing will be phased in later with all testing completed by November 1978. Army Systems Acquisition Review Council (ASARC III) Production Validation Test-Government (PVT-G) (DT III) will commence July 1980 and be completed March 1981. An Army Materiel Systems Analysis Activity independent evaluation will be provided to ASARC III.

2. Operational Test and Evaluation:

- a. Operational Test I (OT I) was conducted by the Operational Test and Evaluation Agency (OTEA) at the Test and Evaluation Command, Aberdeen, MD, and San Jose, California from 20 February 1973 - 20 July 1973. OT was combined with ADVT-G in that the same three candidate prototype weapons evaluated in ADVT-G were evaluated in separate operational subtests against the baseline M139 20mm weapon. OTEA designed the operational subtests, collected the data and reported the results. Using soldiers with mechanized infantry and armored cavalry experience permitted OTEA to assess operator, weapon and firing station interface in a mock-up of a unit. Additionally, operator handling and maintenance operations were evaluated.
- b. As a result of ADVT-G and OT I, the DSARC II recommended and the Deputy Secretary of Defense directed that the Army (1) proceed with production engineering and improvement by Ford Aerospace and Communications Corporation of the KBA B02 baseline design as the self-powered candidate for the 25mm weapon system, (2) proceed immediately with full-scale development of a standard 23mm ammunition and (3) initiate immediately an aggressive program to develop an externally powered gun, to fire the standard 23mm ammunition, as a second candidate for the 25mm weapon system.

# Budget Activity #4 - Tactical Programs

Program Element #6.46.17.A

Title Vehicle Rapid Fire Weapon System - BUSHMASTER

c. Operational Test II (OT II) is scheduled to be conducted in April-July 1978 prior to the decision to enter Low Rate Initial Production (LRIP). OT II will compare the two 25mm automatic cannon systems (the self-powered and the externally-powered). OT II will be an Operational Test and Evaluation Agency (OTEA) directed test, separate from Prototype Qualification Test (PQT-G) and will be conducted at Fort Benning, GA using Mechanized Infantry Troops as player participants. OTEA will provide an independent evaluation to Army System Acquisition Council III (ASARC III). OT III is scheduled to be completed in January 1981 and OTEA will provide an independent evaluation to ASARC IIIa.

## 3. System Characteristics.

### Operational/Technical Characteristics

| Operational/Technical Characteristics | Objectives 1/                 | Demonstrated                  |
|---------------------------------------|-------------------------------|-------------------------------|
| Reliability                           |                               |                               |
| Mean Rounds to Stoppage               | 2,000                         | 286 3/                        |
| Durability (Rounds)                   |                               |                               |
| Receiver                              | 25,000                        | 2/                            |
| Barrel                                | 3,750                         | 2/                            |
| Other Parts                           | 3,000                         | 2/                            |
| Maintainability (minutes)             |                               |                               |
| Field Strip                           | 4                             | 4.7                           |
| Mean Time to Repair                   | 15                            | 1.8                           |
| Caliber                               | 25mm                          | 25mm                          |
| Feed System                           | Dual/Instantaneous            | Dual/Instantaneous            |
| Rate of Fire                          | Variable to 550 shots per min | Variable to 550 shots per min |
| Armor Piercing Ammunition             |                               | Meets requirement             |
| High Explosive Ammunition             |                               | Meets requirement             |

1/ To be demonstrated in Production Validation Test (PVT-G)

2/ To be determined during PQT-G.

3/ Although demonstrated reliability performance is significantly below the ultimately required objective, it is considered to be on the normal reliability, availability and maintainability growth curve and an acceptable risk prior to entering ED. Item is now undergoing production engineering and improvement to increase reliability.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.19.A

Title Landmine Warfare

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976<br>14831 | FY 1977<br>5239 | FY 1977<br>8459 | FY 1978<br>9251 | FY 1979<br>17200 | Additional to Completion Continuing | Total Estimated Cost<br>Not Applicable |
|----------------|--------------------------------------|------------------|-----------------|-----------------|-----------------|------------------|-------------------------------------|--|
|                | TOTAL FOR PROGRAM ELEMENT Quantities |                  |                 |                 |                 |                  |                                     |  |
| D016           | Mine Systems                         | 315              | 231             | 390             | 6009            | 15950            | Continuing                          | Not Applicable                         |
| D377           | Antipersonnel Artillery              |                  |                 |                 |                 |                  |                                     |  |
|                | Mine M692/M731                       | 300              | 0               | 0               | 0               | 0                | 0                                   | 4675                                   |
| D427           | Antitank Artillery Mine              |                  |                 |                 |                 |                  |                                     |  |
|                | XM718/XM741                          | 4315             | 800             | 1828            | 0               | 0                | 0                                   | 16025                                  |
| D558           | Ground Emplaced Mine                 |                  |                 |                 |                 |                  |                                     |  |
|                | Scattering System Antitank/          |                  |                 |                 |                 |                  |                                     |  |
|                | Antipersonnel Mines                  | 9901             | 4208            | 6241            | 3242            | 1250             | 400                                 | 30464                                  |

BRIEF DESCRIPTION OF ELEMENT: Contains four projects which are to provide a family of scatterable, self-destructing antipersonnel and antitank mines, capable of rapid delivery by artillery, ground dispenser, aircraft, modular pack, and other means which prove efficient and cost effective.

BASIS FOR FY 1978 RATE REQUEST: Funds will support completion of Developmental Testing II/Operational Testing II on the ground emplaced mine scattering system (GEMSS). Engineering design and testing of the command initiated Modular Pack Mine System (MOPMS) and support of the Joint Service (GATOR) mine system will continue. Initiate engineering design and testing of the Sensor Tank Off-route Mine System (SOPMS) and the Wide Area Mine (WAM).

BASIS FOR CHANGE IN FY 1978 RATE FY 1977: Increase in funding requirements reflects initiation of engineering development of MOPMS, STORMS, and WAM.



Budget Activity #4 - Tactical Programs

Program Element #6.46.19.A Title Landmine Warfare

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | <u>RDTE</u> | <u>PROCUREMENT</u> | <u>TOTAL</u> |
|----------------------------|-------------|--------------------|--------------|
| (1) Federal Civ. Employees | 27          | 0                  | 27           |
| (2) Contractor Employees   | 100         | 0                  | 100          |
| Total                      | 127         | 0                  | 127          |

**DETAILED BACKGROUND AND DESCRIPTION:** The objective of this program element is to provide a family of scatterable, self-destructing antipersonnel and antitank/antivehicle mines capable of rapid and remote delivery by artillery, ground vehicle, rotary wing aircraft, and other delivery means as deemed efficient and cost effective. These systems will supplement available hand and machine emplaced mines. This new family of scatterable, self-destructing mines satisfies new concepts in barrier operations and provides commanders the capability of using mines in offensive roles. Scatterable minefields will improve the Army's ability to emplace rapid reaction minefields in adequate densities, reasonable sizes, within expected time constraints.

**RELATED ACTIVITIES:** This program follows from advanced development program element 6.36.06.A, Landmine Warfare, which covers components and end items related to mines. Primary technical responsibility rests with the Project Manager for Selected Ammunition who, through formal mutual support agreements with US Army Armament Research and Development Command (AARADCOM), US Army Test and Evaluation Command, US Army Mobility Equipment Research and Development Command (MERADCOM), Naval Weapons Center, and Harry Diamond Laboratories, maintains direct life cycle management control on all phases of mine systems development, procurement, logistical, and field support. Principal system technical development responsibility has been assigned to AARADCOM, Dover, New Jersey. Included in this program element is the Army effort for the Joint-Service development of aircraft delivered scatterable mines. The scope of the development is contained in an approved joint development plan. Joint Service mine requirements are coordinated through the DOD Air Munitions Requirements and Development Committee and the Joint Technical Coordination Group for Bombs and Mines.

**WORK PERFORMED BY:** The principal Army Agency is the Project Manager for Selected Ammunition, AARADCOM, Dover, New Jersey. In-house support is provided by the Mobility Equipment Research and Development Command, Fort Belvoir, Virginia; Yuma Proving Ground, Yuma, Arizona; AERADCOM, Aberdeen, Maryland; and the Naval Weapons Center, China Lake, California. Principal contractors are: Aerojet Ordnance and Manufacturing Company, Downey, California; Hughes Aircraft Company, Fullerton, California; Honeywell Incorporated, Hopkins, Minnesota; RCA Solid State Division, Somerville, New Jersey; AAI Corporation, Cockeysville, Maryland; Chamberlain Corporation, Waterloo, Iowa; Bulova, Valley Stream, Long Island, New York; Hamilton Watch Company, Lancaster, Pennsylvania; Action Manufacturing Company, Philadelphia, Pennsylvania; REDM Manufacturing Company, Wayne, New Jersey. Fairchild Camera, Syosset,

Budget Activity #4 - Tactical Programs

Program Element #6.46.19.A Title Landmine Warfare

Long Island, New York; Etowah Manufacturing Company, Gadsden, Alabama; Hercules Incorporated, Fort Huron, New York; Atlas Chemical Company, Wilmington, Delaware; ORI, Fort Walton Beach, Florida; Cincinnati Mil-A-Chron, Cincinnati, Ohio; Hecherthoron, Dyerburg, Tennessee; and PMC, San Jose, California.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Through 1969, a wide variety of antitank (AT) and antipersonnel (AP) mines were standardized including the M21 AT mine, the M18A1 Claymore AP mine, and the M66 AT off-route mine. Scatterable mine development was initiated in the late 1960's with emphasis on the XM56 helicopter delivered AT mine system and the XM692E1/XM731 artillery delivered AP mine system. During FY 1973, the XM57 AT mine dispenser for M15 AT mines was type classified standard and fielded; the XM56 and XM692E1/XM731 systems entered Developmental Testing (DT); and the XM718/XM741 artillery delivered AT mine system entered engineering development. In FY 1974, the XM616 magnetic fuze for the M21 mine and the XM56 helicopter AT mine system were type classified standard. During FY 1975, the M36 AT mine system went into production; DT II/Operational Testing (OT) II continued on the XM692E1/XM731 AP mine system; and engineer design tests continued on the XM718/XM741 AT mine system. Design and testing of the ground emplaced mine scattering system (GEMSS) and its associated XM75 AT mines, and XM74 AP mines, continued with emphasis on system reliability, maintainability, and human factors. The XM58 helicopter dispensed minefield marking system effort was redirected towards a rapidly emplaced marking system for hand emplacement. Efforts continued on the Joint-Service GATOR air delivered mine with the Air Force and Navy. During FY 1976, DT II/OT II was initiated on the XM718/XM741 AT system; the M692/M731 AP artillery delivered system was type classified standard and went into initial production; DT II/OT II test hardware for the GEMSS was procured and DT II/OT II on the minefield marking system continued.
2. FY 1977 Program: Complete DT II/OT II on the XM718/XM741 artillery delivered AP mine system; initiate DT II/OT II on the XM128 GEMSS AT/AP mine system; and initiate design of an expendable AT and AP mine dispensing system (Modular Pack Mine System - MOPMS).
3. FY 1978 Planned Program: Type classify standard the XM718/XM741 artillery delivered AT mine system. Complete DT II/OT II on the GEMSS and type classify standard. Initiate engineer design testing on the MOPMS and the Sensor Tank Off-Route Mine System (STORMS). Initiate engineer design on the Wide Area Mine (WAM). Increased funding required to initiate engineering development of MOPMS, WAM, and STORMS.
4. FY 1979 Planned Program: Initiate DT II/OT II on the MOPMS and STORMS. Continue engineer design testing of the WAM. Initiate engineer design testing of rapid manually emplaced AT and AP mines. Initiate production of the GEMSS. Increased funding required to procure DT II/OT II test hardware for MOPMS and STORMS.
5. Program to Completion: This is a continuing program.

FY 1978 BOTE DESCRIPTIVE SUMMARY

Program Element #6.46.19.A

Title Landmine Warfare

Project #D016

Title Mine Systems

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to provide scatterable, self-destructing antipersonnel and antitank mines capable of remote delivery by aircraft or artillery. Particular emphasis will be placed on off-route mine systems, wide area mine systems, and remotely controlled arm, disarm and destruct systems, and the minefield recording/marketing system. These systems are designed to enhance the Army's effectiveness by providing a rapid reaction barrier capability and reduce current manpower requirements.

RELATED ACTIVITIES: This project follows from advanced development Program Element 6.36.06.A, Landmine Warfare, which is concerned with mine components and mine systems. Included in this project is the Army effort on the Joint-Service development of aircraft delivered scatterable mines (GATOR). Requirements for mines are coordinated between the Services by the DOD Air Munitions Requirements and Development Committee (AMRAD).

WORK PERFORMED BY: The principal Army agency is the Project Manager for Selected Ammunition, US Army Armament Research and Development Command (ARRADCOM), Dover, New Jersey. In-house support is provided by the Mobility Equipment Research and Development Center, Fort Belvoir, Virginia; Yuma Proving Ground, Yuma, Arizona; ARRADCOM, Aberdeen, Maryland; and the Naval Weapons Center, China Lake, California. The principal contractors are: Aerojet Ordnance and Manufacturing Company, Downey, California; Hughes Aircraft Company, Fullerton, California; and Chrysler Corporation, Warren, Michigan.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Engineering development was initiated on the artillery delivered antipersonnel and antitank mines, XM692E1/XM731 and XM718/XM741 respectively. These items are now separate projects. The M56 helicopter dispensing mine system completed development and was type classified standard. A hand emplaced minefield marking system (HEMMS) development was initiated on an expedited basis. The Army assumed responsibility for design and development of the Joint-Service (GATOR) air delivered scatterable mine program based on cost studies and the availability of mine components from the Army family of scatterable mines.
2. FY 1977 Program: Complete Developmental Testing II/Operational Testing II (DT II/OT II) on the HEMMS. Initiate full scale development on the Modular Pack Mine System (MOPMS).

**Budget Activity #4 - Tactical Programs**

**Program Element #6.46.19.A**

**Title Landmine Warfare**

**Project #D016**

**Title Mine Systems**

3. **FY 1978 Planned Program:** Continue design and development of the Modular Pack Mine System (MOPMS). Conduct initial tests to evaluate system performance. **Produceability engineering and planning (PEP)** efforts will be initiated. Initiate engineer design testing on the Sensor Tank Off-Route Mine System (STORMS) and the Wide Area Mine (WAM). Continue efforts on the joint-Service development of aircraft delivered scatterable mines (GATOR). Increased funding required to procure test hardware and conduct engineer tests on the MOPMS, STORMS, and WAM.

4. **FY 1979 Planned Program:** Procure hardware and initiate Developmental Testing II (DT II/OT II) on the MOPMS. Continue engineer design testing on the WAM. Conduct DT II/OT II on the STORMS. Initiate design and development of the Remote Minefield Identification and Display System (REMIDS). Conduct DT II/OT II on the antipersonnel and antitank Rapid manually emplaced mine systems. Continue efforts on GATOR. Increased funding reflects increased efforts on the WAM, the STORMS, and the initiation of REMIDS.

5. **Program to Completion:** This is a continuing program.

**RESOURCES: (\$ in Thousands)**

|             | FY 1976  | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost | Not Applicable |
|-------------|--|---------|---------|---------|--------------------------|----------------------|----------------|
|             |  |         |         |         |                          |                      |                |
| RDTE: Funds | 315  | 231     | 390     | 6009    | 15930                    | Continuing           |                |
| Quantities  | Not feasible to list because of large number of diverse items. |         |         |         |                          |                      |                |



FY 1978 RDIE DESCRIPTIVE SUMMARY

Program Element #6.46.19.A

Title Landmine Warfare

Project #D568

Title Ground Emplaced Mine Scattering System with Antitank and Antipersonnel Mines

Category Engineering Development

Budget Activity #4 - Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop a scatterable mine surface dispensing system consisting of a ground vehicle mounted dispenser and associated mines, both antitank (AT) and antipersonnel (AP), capable of meeting approved Army requirements. As with other scatterable mines, these mines will have a self-destruct feature and an area sensing capability.

RELATED ACTIVITIES: This project followed from advanced development in Program Element 6.36.06.A, Project D006, Landmine Warfare, which encompasses components and end items related to the mines. Technology developed in this project is also being incorporated in the GATOR mine program, a joint-service air delivered scatterable mine system. GATOR is proceeding under a Joint Development Plan for an air delivered antipersonnel (AP) and antitank/antivehicular (AT/AV) target activated munition system to satisfy a joint service operational requirement.

WORK PERFORMED BY: The principal Army agency is the Project Manager for Selected Ammunition, US Army Armament Research and Development Command (ARRADCOM), Dover, New Jersey. The principal contractors are: FMC, Santa Clara, California; Honeywell Incorporated, Hopkins, Minnesota; Aerojet Ordnance and Manufacturing Company, Downey, California; RCA Solid State, Sommerville, New Jersey; and AVCO, Wilmington, Massachusetts.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: Components for this system were developed in P.E. 6.36.06.A, Landmine Warfare. The ground emplaced mine scattering system (GEMSS) entered engineering development in 3Q FY 1974. During FY 1975, engineering design and testing continued. Special attention was given to system safety, reliability, and human engineering. A prototype system was sent to Germany for user evaluation. During FY 1977 and FY 1976, Engineering Development Test (EDT) was concluded and procurement of Developmental Testing II/Operational Testing II (DT II/OT II) was initiated. Productibility engineering and planning (PEP) program was initiated.
2. FY 1977 Program: Complete fabrication of DT II/OT II dispenser and mine hardware. Initiate DT II/OT II on the entire system.
3. FY 1978 Planned Program: Complete DT II/OT II and prepare for the developmental acceptance in-process review. Complete productibility engineering and planning and finalize the technical data package. Funds reduced significantly due to phase down of entire effort prior to completion.



Budget Activity #4 - Tactical Programs

Program Element #6.46.19.A

Title Landmine Warfare

Project #D568

Title Ground Emplaced Mine Scattering System with Antitank and Antipersonnel Mines

4. FY 1979 Planned Program: Type classify standard and begin production. Funds reduced significantly due to phase down of entire effort prior to completion.

5. Program to Completion: Not applicable.

6. Major Milestones:

- a. Initiate Developmental Testing II/Operational Testing II (OT II/OT II)
- b. Development Acceptance In-Process Review and Type Classify Standard
- c. Production Validation In-Process Review

RESOURCES: (\$ in Thousands)

|                          | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|--------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                          |         |         |         |         |                          |                      |
| RDIE: Funds              | 9901    | 4208    | 3242    | 1250    | 400                      | 30464                |
| Quantities <sup>1/</sup> |         |         |         |         |                          |                      |
| Procurement:             |         |         |         |         |                          |                      |
| Funds                    | 0       | 0       | 0       | 7000    | 132600                   | 139600               |
| Quantities (each)        |         |         |         |         |                          |                      |
| Dispenser                |         |         |         | 6       | 490                      | 496                  |
| Antitank Mines           |         |         |         | 12454   | 375223                   | 387677               |
| Antipersonnel Mines      |         |         |         | 6226    | 174252                   | 180478               |

Estimated RDTE Cost to Reach Events (Cumulative)

20390  
23592  
30464

<sup>1/</sup> Only dispensers listed. Listing of mines and components is not feasible due to large number of diverse items.

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.20.A

Title Tank Systems

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                            | FY 1976      | FY 1977       | FY 1978       | FY 1979      | Additional to Completion | Total Estimated Cost |
|----------------|----------------------------------|--------------|---------------|---------------|--------------|--------------------------|----------------------|
|                | <u>TOTAL FOR PROGRAM ELEMENT</u> | <u>52835</u> | <u>105749</u> | <u>117746</u> | <u>76757</u> | <u>31709</u>             | <u>584649</u>        |
|                | Quantities                       |              |               |               |              |                          | 17                   |
| DC20           | XM1                              | 52835        | 105749        | 117746        | 76757        | 31709                    | 584649               |
| Procurement:   | Funds                            | 0            | 35600         | 182700        | 400400       | 3576100                  | 4194800              |
|                | Quantities                       | 0            | 0             | 0             | 110          | 3202                     | 3312                 |

BRIEF DESCRIPTION OF ELEMENT: The XM1 is a four man, highly mobile, fully tracked vehicle with significantly improved survivability provided by improved ballistic protection and compartmentalization. The XM1 will mount a large caliber main gun and two or more complementary armament systems with improved fire control and shoot-on-the-move capabilities. Higher cross-country speeds and faster acceleration provided by a 1500 horsepower turbine engine will make the XM1 tank a more difficult target for opposing ground and air forces.

BASIS FOR FY 1978 RDTE REQUEST: Chrysler Corporation will continue the design effort leading to the fabrication of eleven pilot vehicles for Development Test/Operational Test (DT/OT) testing in 1978. Continued development of the armor configurations and compartmentalization techniques must be accomplished during this time. Continuation of system engineering, configurations management and engine durability testing will be accomplished during this period. System Engineering Management (SEM) contractors will continue to be used to identify and recommend means for reducing cost of production hardware. Kit and training device development will also be continued during this period.

# Budget Activity #4 - Tactical Programs

Program Element #6.46.20.A Title Tank Systems

**BASIS FOR INCREASE IN FY 1978 OVER FY 1977:** FY 1977 marked the end of the XM1 Validation Phase (120 day resolicitation extension) with its related reduction in material costs and level of labor effort. FY 1978 funding level reflects the increase in material and labor effort associated with the fabrication of eleven pilot vehicles during the Full Scale Engineering Development (FSED) Phase for Development Test/Operational Test (DT/OT II) Test and Evaluation.

## TERMINATION COST: (\$ in Thousands)

(1) Estimated Government Liability Financed with:

|          | FY 1977 | FY 1978 | Total |
|----------|---------|---------|-------|
| \$ Prior | 19100   | 11700   | 30800 |

## PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                           | RDTE | Procurement | Total |
|---------------------------|------|-------------|-------|
| (1) Federal Civ Employees | 399  | 0           | 399   |
| (2) Contractor Employees  | 1345 | 480         | 1825  |
| Total                     | 1744 | 480         | 2224  |

**DETAILED BACKGROUND AND DESCRIPTION:** Congress terminated the XM803 program in FY 1972 as unnecessarily complex, excessively sophisticated and too expensive and directed initiation of a new tank prototype program. To determine the requirements and characteristics of a new tank, the Army formed a task force to prepare a requirements document. The objective of this program is to counter the quantitatively superior Soviet tank forces by producing a qualitatively superior tank for use as the primary weapons systems in a highly mobile, sustainable, combined arms force. The XM1 will be superior in the areas of survivability, firepower and mobility and hence will provide a dramatic increase in combat capability. The ballistic protection offered by special armor coupled with inherent agility makes the XM1 significantly more survivable than the M60 tanks. Silhouette will be reduced and compartmentalization stressed to reduce vulnerability to anti-tank fire. The main gun will be a stabilized large caliber gun (105-120mm). Fire control and night vision components will utilize advancements in technology to provide superior performance with reduced cost and complexity. A 1500 HP engine with matching transmission provides power to the running gear. The suspension system is a high performance system which provides superior cross-country mobility. The program was approved on 18 January 1973 and contracts awarded to General Motors and to Chrysler on 28 June 1973 for the competitive Validation Phase of the XM1 program. Competitive evaluation of the two prototypes was completed on schedule (July 1976); however, the final Defense Systems Acquisition Review Council (DSARC) decision on the selection of a single FSED contractor was delayed 120 days until a resolicitation, considering a standardized version of the XM1 could be developed. Testing of the Leopard 2, American Version (AV) tank in accordance with the Dec 74 United States/Federal Republic of Germany (US/FRG) harmonization Memorandum of Understanding (MOU) was initiated on 10 Sep 76.

Budget Activity #4 - Tactical Programs

Program Element #6.46.20.A Title Tank Systems

RELATED ACTIVITIES: There is no other program being conducted by other services that meets the XM1 requirements. The Marine Corps is closely monitoring the XM1 development in relation to their requirement for a battle tank in a high intensity environment for subsequent operations ashore. Related Army activities being conducted are as follows: Program Element (PE) 6.36.16.A, Tank Gun Cooperative Development; PE 6.36.08 - D161, Tank Ammunition (XM774); PE 6.46.02 - DG21, Tank Ammunition (XM735); and PE 6.46.15 - DF25, Tank Thermal Sight.

WORK PERFORMED BY: Contractors are: Chrysler Corporation, Detroit, MI; General Motors Corporation, Indianapolis, IN; and FMC Corporation, San Jose, CA. In-house work is being done by the US Army Tank Automotive Research and Development Command, Warren, MI; and the US Army Armament Research and Development Command, Dover, NJ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1976, FY 76 and Prior Accomplishments: A Parametric Design/Cost Effectiveness (PD/CE) Study to determine the design characteristics and possible alternatives for the XM1 was accomplished. Both contractors completed trade-off analysis and design studies and selected the optimum vehicle configuration. Cost and specification studies were updated. Fabrication and assembly of the prototype vehicles, ballistic hull and turrets, and retrofit of test rigs for government competitive test and evaluation were accomplished. In-house efforts to develop and evaluate manufacturing techniques for hulls and turrets and feasibility studies to determine types and quantities of training devices required were conducted. Foreign technology evaluations continued with the establishment of a program for the test and evaluation of a modified German prototype, the Leopard 2, as an alternative for the XM1 requirement. As part of the US/Federal Republic of Germany (FRG) agreement a jointly funded cost/produciability study was initiated with FMC corporation.
2. FY 1977 Program: The Full Scale Engineering Development (FSED) phase began on 12 November 1976 following contract award to Chrysler Corporation. Fabrication of eleven pilot vehicles will begin and six armor test sections for government test and evaluation will be delivered. Contractor will continue design efforts to meet system specifications in configuration management, integrated logistics support and human engineering. Testing and evaluation of a modified Leopard 2 tank will be completed leading to a special Defense System Acquisition Review Council (DSARC) decision in March 1977. In-house development and evaluation of special armor configurations will be continued. Extended durability testing of the turbine engine will be initiated.
3. FY 1978 Planned Program: Fabrication of pilot vehicles and refurbishing of prototype vehicle and automotive test rig will be completed and delivered along with special kits and maintenance support package. Support of Development Test (DT) II and Operational Test (OT) II, prototype qualification tests, and engineering design testing on refurbished prototype vehicles will be conducted. Armor development effort and extended durability testing of the turbine engine will continue.

Budget Activity #4 - Tactical Programs

Program Element #6.46.20.A Title Tank Systems

4. FY 1979 Planned Program: Development Test/Operational Test (DT/OT) II will be completed. Redesign and testing as required to correct deficiencies noted in DT II/OT II will be conducted. Low Rate Initial Production (LRIP) contract will be awarded following completion of Full Scale Engineering Development (FSED) and Defense Systems Acquisition Review Council (DSARC) decision to continue the program. The decreased funding requirements in FY 1979 reflect a reduction in hardware costs required for FSED and the transition to the LRIP phase of development.

5. Program to Completion: Delivery of the 110 LRIP vehicles is expected to begin in February 1980 and be completed in January 1981. DT III/OT III will be conducted from March to October 1980. The decision to enter full scale production will be made at DSARC III A, scheduled for February 1981. The second production increment will begin subsequent to the DSARC decision with first delivery expected in May 1981.

6. Major Milestones:

|   | Date   | Estimated RDTE Cost to Reach Events (Cumulative) |
|---|--------|--|
| a. Award two prototype development contracts            | Jun 73 | 20,000   |
| b. FSED contract award (validation complete (DSARC II)) | Nov 76 | 226,000  |
| c. Limited production decision (DSARC III)              | Mar 79 | 514,400  |
| d. First vehicle delivery (LRIP)                        | Feb 80 | 576,400  |
| e. Full production decision (DSARC III A)               | Feb 81 | 569,000  |



Budget Activity #4 - Tactical Programs

Program Element #6.46.20.A

Title Tank XM-1

TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

a. Both US contractors, Chrysler and General Motors, have completed their design, construction and testing. Neither experienced schedule slips or costs overruns. A Source Selection Evaluation Board (SSEB) convened 1 March 1976 and submitted their findings to the Source Selection Advisory Council on 4 June 1976. The final selection of the winner and award of a full scale engineering development (FSED) contract was expected to take place in late July 1976, following the 20 July 1976 Defense Systems Acquisition Review Council (DSARC) II. However, the validation phase was extended 120 days as a result of the Secretary of Defense decision to consider incorporation of standardized components as outlined in the 28 July 1976 Addendum to the Memorandum of Understanding (MOU) with the Federal Republic of Germany. On 12 Nov 1976, the Source Selection Authority (SSA) announced that Chrysler Corporation was selected as the winning US contractor to continue development of the XM-1 tank. The award of the FSED contract to Chrysler was made the same date for the fabrication of eleven pilot vehicles. The FSED contract includes an option for follow-on production of 462 vehicles in FY 80-81. A Modified Leopard 2 (AV-American Version) prototype is also being evaluated as a competitor for the XM-1 requirement. It is now anticipated that the decision as to which tank will be selected as the US main tank, i.e. XM-1 or Leopard 2, will be announced on or before 31 Mar 1977. Development testing will be accomplished at three critical times in the development cycle to determine the degree to which XM-1 tank system meets performance specifications.

b. Phase I of Development Test (DT) I was conducted by the US Army Test and Evaluation Command (TERCOM) at Aberdeen Proving Ground, MD, 1 Feb-30 Apr 76 to resolve critical issues and provide data for the selection of one contractor and decision to enter FSED. Testing of US prototypes was completed on schedule with both vehicles having successfully demonstrated the ability of meeting or exceeding all XM-1 requirements. Testing began of the Leopard 2 (AV) on 10 Sep 76 and was completed in mid Dec 76. The performance of each candidate is evaluated against the performance of the baseline vehicle, the current first line production version of the M60 tank.

c. DT II, utilizing the eleven FSED pilot vehicles, will be conducted Mar 78-Jul 79 to resolve the issues critical to the decision to enter Low Rate Initial Production (LRIP). The FSED vehicle differs from the prototype vehicle tested during the Validation Phase in that it incorporates provisions for standardization of selected components and/or systems between the XM-1 and Leopard 2 in accordance with the addendum to the United States/Federal Republic of Germany Memorandum of Understanding. The standardization effort has as one of its major objectives commonality of logistical support in the area of consumables, such as fuel and ammunition, and in those other areas requiring substantial logistical support such as the gun, track engine, transmission and fire control.

d. DT III is scheduled to be conducted Mar-Oct 80 to verify production changes resulting from Development Test/Operational Test (DT/OT) II deficiencies and to secure a decision to deploy the XM-1 tank system and/or enter full scale production.

# Budget Activity #4 - Tactical Programs

Program Element #6.46.20.A

Title Tank XM-1

## 2. Operational Test and Evaluation:

- a. Three periods of Operational Test (OT) are being conducted to assess the operational effectiveness and military utility of the XM-1 tank. The US Army Operational Test and Evaluation Agency (OTEA) will provide an independent evaluation to the appropriate decision body after each of the three tests prior to the major decision milestones.
- b. Phase I of OT I was conducted by OTEA at Aberdeen Proving Ground, MD, from 15-30 Apr 76. This test was a combined DT I/OT I using one prototype vehicle from each contractor and employed six "User" tank crews. The Modified Leopard 2 (AV) prototype will be evaluated as Phase II by OTEA against the same test criteria in December 1976 at Aberdeen Proving Ground, MD.
- c. A separate OT II utilizing five prototype vehicles will be conducted by OTEA from May-Dec 78. Platoon live fire and company field exercises under simulated tactical conditions will be conducted, using a typical "User" tank company. Reliability, availability, and maintainability (RAM) experience will be collected.
- d. OT III will be conducted by the US Army Training and Doctrine Command (TRADOC) Combined Arms Test Activity at Fort Hood, TX, from May-Sep 80. This will be a battalion level test utilizing troops from resident Fort Hood armored units. This test will evaluate all transition training, formal military school training, logistical requirements, and validation of doctrinal, tactical, and operational concepts. Reliability, availability, and maintainability (RAM) experience will also be collected.

## 3. System Characteristics:

### Operational/Technical Characteristics

| Characteristics   | Objective | Demonstrated Performance |
|---|-----------|--------------------------|
| Acceleration (hard surface 0° slope, 0 to 20 mph)                     | 6-9       | 1/                       |
| Speed (mph)   |           |                          |
| 10% slope   |           |                          |
| Cross-country, sustained  | 20-25     | 1/                       |
| Cruising range (miles)  | 25-30     | 1/                       |
| Horsepower/weight (ton)   | 275-325   | 1/                       |
| Height (inches)   | 26-30     | 1/                       |
| Width (inches)  | 90-95     | 1/                       |
| Stowed ammunition (main gun rounds)                                   | 120-144   | 1/                       |
| Reliability (Mean Miles Between Failure - 1978F)                      | 40-50     | 1/                       |
| Durability (miles)  | 320-440   | 1/                       |
| Availability (inherent)   | 4000-6000 | 1/                       |
| Maintenance ratio (maintenance man hours/operational)                 | 89-92     | 1/                       |
| 1/ To be demonstrated during Development Test II/Operational Test II. | 0.66-1.25 | 1/                       |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.21.A

Title COPPERHEAD (Cannon Launched Guided Projectile)

Category Engineering Development

Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 14000   | 3000    | 36028   | 363     | 0                        | 118017               |
| D073           | COPPERHEAD                           | 14000   | 3000    | 36028   | 363     | 0                        | 118017               |
| Procurement:   | Funds                                | 0       | 0       | 16900   | 131700  | 825500                   | 974100               |
|                | Quantities                           | 0       | 0       | 0       | 8000    | 102236                   | -                    |

**BRIEF DESCRIPTION OF ELEMENT:** The COPPERHEAD is designed to attack both stationary and moving hard point targets such as tanks with a high probability of achieving first round kills. The projectile is fired from a conventional 155mm howitzer toward a target which has been illuminated by a forward observer using a laser designator. During the final phase of the trajectory, the projectile acquires and homes on the laser energy reflected from the target.

**BASIS FOR FY 1978 RDTE REQUEST:** Completion of the Producibility Engineering and Planning (PEP) phase of Engineering Development coupled with completion of the bulk of Prototype Qualification Test (PQT) and Operational Tests (OT II). The majority of Developmental Testing (DI II) will also be conducted.

**BASIS FOR CHANGE IN FY 1978 OVER FY 1977:** Component and subsystem design and testing, Producibility Engineering and Planning, and limited projectile firings to determine readiness for Prototype Qualification Testing were the primary efforts during FY 1977. In FY 1978, PEP will be completed and a significant increase in the number of complete projectiles manufactured and tested will be experienced. These activities account for the increase in the program in FY 1978.

Budget Activity #4 - Tactical Programs

Program Element #6.46.21.A

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |                       |       |       |
|----------------------------|------|-------------|-------|-----------------------|-------|-------|
| (1) Federal Civ. Employees | 163  | 0           | 163   |                       |       |       |
| (2) Contractor Employees   | 193  | 145         | 338   | (1) Estimated Govern- | 81626 | 0     |
|                            |      |             |       | ment Liability        |       | 81626 |
|                            |      |             |       | Financed with:        |       |       |
| Total                      | 356  | 145         | 501   |                       |       |       |

**DETAILED BACKGROUND AND DESCRIPTION:** A requirement exists to increase the indirect fire capability of field artillery cannon units by providing projectiles that, by use of a ballistic trajectory coupled with terminal guidance, will acquire and home on stationary and moving, hard, point targets. The projectile under development, the COPPERHEAD, will satisfy that requirement. The COPPERHEAD concept involves the firing at hard, point targets from cannon artillery as directed by a ground or air observer. During the final portion of the trajectory, the observer illuminates the target with a narrow beam laser. The COPPERHEAD then acquires the reflected laser energy and guides to the target by homing on the reflected energy. The COPPERHEAD is a 155mm guided projectile which utilizes semi-active laser homing and proportional navigation guidance. It is designed to have a range of 16 to 24 kilometers and carries a shaped charge warhead that can penetrateable and planned projectiles in field artillery cannon units.

**RELATED ACTIVITIES:** The Army provided \$2.3 million through FY 1974 for support of Naval Weapons Systems Command in the development of an 8-inch pursuit guided projectile. The Navy furnished \$722 thousand in FY 1975 for a 5-inch/155mm commonality evaluation which included testing of 12 full-up Advanced Development 5-inch guided projectiles sabotored to 155mm provided by the Navy. An extensive investigation has been undertaken to examine the prospects for component/projectile commonality between the Army 155mm projectile and the Navy 5-inch projectile in order to avoid duplication of effort and to achieve maximum possible savings.

**WORK PERFORMED BY:** US Army Armaments Research and Development Command, Dover, New Jersey; US Army Missile Research and Development Command, Huntsville, Alabama; Project Manager, Cannon Artillery Weapons Systems, Dover, New Jersey; Martin Marietta Corporation, Orlando, Florida; Harry Diamond Laboratories, Adelphi, Maryland; Test and Evaluation Command, Aberdeen, Maryland.

Title COPPERHEAD (Cannon Launched Guided Projectile)

TERMINATION COST: (\$ in Thousands)

|  |         |         |       |
|--|---------|---------|-------|
|  | FY 1977 |         |       |
|  | and     |         |       |
|  | Prior   | FY 1978 | Total |
|  |         |         |       |



Budget Activity #4 - Tactical Programs

Program Element #6.46.21.A

Title COPPERHEAD (Cannon Launched Guided Projectile)

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: The COPPERHEAD program began in 1971 with \$1.6 million emergency funds to conduct in-house systems studies. Semi-active laser homing was selected for use during the initial phase of the program because it was the most technically advanced. In February 1972, contracts were signed with Texas Instruments and Martin Marietta to conduct a two-phase competitive prototype demonstration. Phase I of the demonstration was completed in September 1973 with each contractor demonstrating the capability of projectile components to survive the 10,000 "g" cannon launch environment. Phase II was initiated in September 1973. Each contractor fabricated and delivered to the Army 3 fully functional prototype projectiles with telemetry for testing. Tests were completed in June 1974. In-house fuze and warhead design tests were on-going. In January 1975, a Special Commonality Defense Systems Acquisition Review Council (DSARC) directed the Army to continue the Advanced Development program. Each contractor delivered the last nine initial design projectiles for test and evaluation. Sixteen of these 18 prototype projectiles and six of the 12 Navy 5-inch/153mm prototype projectiles were tested and evaluated. DSARC II was conducted in June 1975 and approval to enter Engineering Development was received. The Engineering Development (ED) contract was awarded to the Martin Marietta Corporation in July 1975. Warhead and fuze development will be accomplished by the ED contractor, thereby giving him complete design responsibility. The FY 1976 and FY 1977 funding was reduced by over 31 percent (from \$24.8 million to \$17.0 million) necessitating a complete program restructure which resulted in a program slip of six months and the initiation of ED at a lower level than initially anticipated. During FY 1976 and FY 1977, design changes to the warhead, fuze, roll-rate sensor and seeker gyro were tested. The final two Army prototypes were successfully fired. The first was fired at a tank illuminated by a designator mounted in a Remotely Piloted Vehicle (RPV) and the second was fired at a moving tank illuminated by a helicopter-mounted designator during darkness. The majority of component testing was completed and subsystem development testing was continued.
2. FY 1977 Program: During FY 1977, all developmental testing of subsystems will be completed and ED testing of complete rounds will be initiated. The 22 round baseline firings will be completed to demonstrate all flight performance requirements including the fly under-fly out (FUFO) capability and a 15 round System Qualification Test will be completed to demonstrate the readiness for Prototype Qualification Test (PQT). Upon receipt of Congressional approval, Producibility Engineering and Planning (PEP) will be initiated.
3. FY 1978 Planned Program: PEP is planned for completion during this period as will the bulk of Prototype Qualification Tests and Development Test/Operational Test (DT/OI ID). Initiation of Procurement of Ammunition, Army is planned with the award of an Initial Production Facilities Contract in October 1977. DSARC III is planned for September 1978.



Budget Activity #4 - Tactical Programs

Program Element #6.46.21.A Title COPPERHEAD (Cannon-Launched Guided Projectile)

4. FY 1979 Planned Program: The remainder of Prototype Qualification Tests (PQT) will be completed and it is planned to award a low rate initial production (LRIP) contract in October 1978. Additional RDTE funding in the amount of \$3.336 million will be required in FY 1979 to complete activities which had been slipped due to the FY 1976/FY 1977 reduction in funding. The significant decrease in required funding compared to FY 1978 is due to reduced activities as development nears completion and the projectile is readied for initiation of LRIP.

5. Program to Completion: Production Validation Testing is planned to be completed in FY 1980 and second source procurement initiated. Additional RDTE funding in the amount of \$5.268 million is required in FY 1980 to support the conduct of Development Tests (DT III) which had not previously been programmed as an RDTE effort.

6. Major Milestones:

|   | Date           | Estimated RDTE Cost to Reach Events (Cumulative) |
|---|----------------|--|
| a. Initiate Advanced Development                          | February 1972  | 1600   |
| b. Initiate Engineering Development                       | July 1975      | 30900  |
| c. Initiate DT/OT II                                      | November 1977  | 81626  |
| d. Defense Systems Acquisition Review Council (DSARC III) | September 1978 | 117430   |
| e. Initial Operational Capability (IOC)                   | -              | 126397   |

Budget Activity #4 - Tactical Programs

Program Element #6.46.21.A

Title COPPERHEAD (Cannon Launched Guided Projectile)

TEST AND EVALUATION DATA:

1. Development Test and Evaluation: The development contractor is the Martin Marietta Corporation, Orlando, Florida. A competitive feasibility demonstration of the Martin Marietta and Texas Instruments advanced development (AD) versions of the COPPERHEAD was completed in April 1975. Targets included panels and both stationary and moving tanks at ranges from 4 to 16 kilometers. The Texas Instruments version achieved a direct hit on a stationary tank that had been designated from a remotely piloted vehicle, and, a direct hit on a moving tank designated by the Airborne Target Acquisition and Fire Control System (ATAFCS). The Naval Surface Weapons Laboratory, Dahlgren, Virginia, also entered the competition in the AD program by sabotaging the Navy 5-inch projectile to 155mm. The Navy version achieved a direct hit on a stationary tank that had been designated from a remotely piloted vehicle, and, a direct hit on a moving tank designated by the Airborne Target Acquisition and Fire Control System (ATAFCS). Prototype Qualification Test for the engineering development version will be primarily conducted by the US Army Test and Evaluation Command (TECOM) at White Sands Missile Range (WSMR) beginning in April 1977. Major subtests include basic performance, environmental qualification, battlefield environment, cold weather performance and range performance and reliability. In addition, nuclear effects, nuclear-biological-chemical decontamination, air transportability and electromagnetic radiation effects will also be tested and firing table data determined. Development Test III (DT III) will be conducted by TECOM at WSMR beginning in December 1979 to verify that the low rate initial production projectiles meet system specifications when manufactured in accordance with production processes.

2. Operational Test and Evaluation: Operational Test I (OT I) was conducted at White Sands Missile Range during 25 March - 30 April 1974. Firings were not included as part of OT I as the projectiles were still under control of the contractors and were unavailable. Test results indicated that a Forward Observer (FO) section equipped with the Ground Laser Locator Designator (GLLD) would successfully complete an artillery fire mission. OT II will be conducted by the Operational Test and Evaluation Agency (OTEA) independent of DT II utilizing prototype hardware and typical user troops. The test is scheduled to be conducted during the period April - June 1978 at Fort Carson, Colorado. OT II will consist of two subtests. The nonfire subtest phase will be conducted under conditions of day, night using night sight, and night using illumination rounds. Acquisition, tracking, engagement, training, and command-control-communications (CCC) will be addressed. During the live fire subtest phase, eighty CLGP rounds with full guidance and control will be fired against single and multiple moving target arrays. Ten of the CLGPs will have live warheads. Conventional artillery missions will be interspersed with CLGP missions. This phase will add to the data base collected in the first phase. OTEA will provide its independent evaluation to the Army Systems Acquisition Review Council prior to entry into low rate initial production. Operational Test III is scheduled to be conducted by OTEA independent of Development Test III utilizing low rate initial production hardware and typical user troops. OT III will be conducted in two phases. Phase I will be a nonfiring exercise at Fort Hood, Texas, during November - December 1979. Phase II will be a live firing exercise at Fort Sill, Oklahoma, during January - April 1980. Operational testing will be complete before signing the production contract. OTEA will provide its independent evaluation to ASARC/DSARC IIIa.

Budget Activity #4 - Tactical Programs

Program Element #6.46.21.A

3. Systems Characteristics:

Operational/Technical  
Characteristics

|  | <u>Objective</u> | <u>Demonstrated</u> |
|--|------------------|---------------------|
| Weight (pounds)                                  | 150              | 137                 |
| Length (inches)                                  | 54               | 54                  |
| Accuracy (CEP-ft)                                | --               | --                  |
| Range (km)                                       | --               | --                  |
| Maximum  | 16-24            | 16                  |
| Minimum  | 1.5-3.0          | 4                   |
| Lethality (Probability of a kill given<br>a hit) | --               | *                   |
| Reliability                                      | --               | *                   |
|  | .96              |                     |

\* To be demonstrated during development and operational testing.

Title COPPERHEAD (Cannon Launched Guided Projectile)

FY 1978 RDT&E DESCRIPTIVE SUMMARY

Program Element #6.46.23.A      Title Improved Lightweight Antitank Weapon (VIPER)  
 Category Engineering Development      Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title                                  | FY 1976 | FY 1977 | FY 1978             | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--|---------|---------|---------------------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities   | 4686    | 1629    | 6515                | 2283    | 0                        | 31132                |
| D072           | VIPER (Improved Light Antitank Weapon) | 4686    | 1629    | 6515                | 2283    | 0                        | 31132                |
| Procurement:   |  |         |         |                     |         |                          |                      |
|                | Funds Quantities (Thousands)           |         |         |                     |         |                          |                      |
| 1/             | Thru FY 82 FYDP                        |         |         |                     |         |                          |                      |
| 2/             | Production Base (Facilities) Program   |         |         |                     |         |                          |                      |
|                |  |         |         | 14700 <sup>2f</sup> |         |                          |                      |
|                |  |         |         |                     | 15000   | 83900 <sup>1/</sup>      | 98900                |
|                |  |         |         |                     | 96      | 577                      | 673                  |

BRIEF DESCRIPTION OF ELEMENT: The objective of this program is to develop a low-cost, lightweight, shoulder-fired antitank weapon to replace the M72A2 Light Antitank Weapon (LAW).

BASIS FOR FY 1978 RDT&E REQUEST: Funding will be used to complete the system test phase of: Prototype Qualification Test - Contractor (PQT-C); Prototype Qualification Test - Government (PQT-G); and Operational Test II (OT II). Producibility Engineering and Planning will continue.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: Significant decrease in FY 1978 RDT&E program funding is primarily due to finalization of major efforts in engineering design testing, alternative design approaches and the fabrication of selected system prototype test hardware.



Budget Activity 04 - Tactical Programs

Title Improved Lightweight Antitank Weapon (VIPER)

Program Element #6.46.23.A

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 56   | 0           | 56    |
| (2) Contractor Employees   | 108  | 230         | 338   |
| Total                      | 164  | 230         | 394   |

**DETAIL BACKGROUND AND DESCRIPTION:** The objective of this program is to develop a low-cost, lightweight, shoulder-fired antitank weapon to replace the M72A2 LAW (Light Antitank/Assault Weapon). A replacement for the M72A2 LAW has been under consideration for several years. A substantial effort has been focused on product improving the current LAW, investigating and testing possible foreign operational and developmental candidates, and developing a strong technology base from which state-of-the-art solutions could be evaluated. After a long and comprehensive review by the user and developer, the requirement for a high performance LAW-type system was reaffirmed. Basically, the requirement described a low-cost, lightweight and effective weapon which could be proliferated on the battlefield as a last-ditch measure to stop enemy armor. The current M72A2 LAW was unacceptable. A product improved LAW, limited by rocket motor and launcher case dimensions, could not be upgraded sufficiently to overcome the serious deficiencies cited for the current LAW. Foreign systems were found to be either too big, too heavy, or too costly to meet the users operational concept and requirement. Having narrowed the replacement to the products of a technology program started earlier, prototypes were manufactured and tested. A high performance LAW type system with slightly larger dimensions, was selected over other candidates as providing the best mix of physical and performance characteristics. This selected concept was definitized in a user requirement and will be developed in this program.

**RELATED ACTIVITIES:** Laboratory developments in Ballistics Technology, 6.26.18, AH80, Small Caliber and Fire Control Technology, 6.26.17, AH19; Missile Technology, 6.23.03, A214; Large Caliber and Nuclear Technology, 6.26.03, AH78; and the Marine development multislot light antitank weapon was related to this VIPER program. In addition, a manufacturing methods technology program, 3753135, paralleled the VIPER development program in order to establish a production process for reducing the cost of manufacturing the rocket motor propellant, carboreane. This program has moved from 6.26.23.A Advanced Development to 6.46.23.A Engineering Development. The Army will satisfy all Service requirements for the Department of Defense. There are no known competing systems.

**WORK PERFORMED BY:** Approximately 95% of the Advanced Development work has been conducted in-house at Army Missile Research and Development Command (ARADCOM), Huntsville, AL; US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; Aberdeen, MD; Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, MD; Harry Diamond Laboratories, Adelphi, MD; Watervliet, NY; Human Engineering Laboratory, Aberdeen, MD; and Anniston Army Depot, Anniston, AL. Approximately 80% of future work is expected to be done on contract. Three prime contractors have shown interest in developing the VIPER, Northrop, Anaheim, CA; General



Budget Activity #4 - Tactical Programs

Program Element #6.46.23.A Title Improved Lightweight Antitank Weapon (VIPER)

Dynamics, Pomona, CA; and Day and Zimmerman, Texarkana, TX. General Dynamics won the bid.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976, and Prior Accomplishments: As a result of the Light Antitank Weapon (LAW) workshop (July 1966 - July 1967), an Advanced LAW program was initiated in the fall of 1967. The objective of this program was to emphasize development of a new high performance rocket motor propellant and to study critical LAW components. A new high performance propellant, using a carborane catalyst, was successfully developed as were several different prototype configurations of LAW type systems. A follow-on program called SMART (Short Range, Manportable, Antitank Weapon Technology) was initiated in November 1971 which refined the technology developed under the Advanced LAW program and tested and evaluated foreign operational and developmental systems. The SMART Program was concluded by the end of FY 1974 by demonstrating state-of-the-art systems. A LAW Technology program was started in July FY 1974 which focused on scaling down the systems demonstrated in the SMART program to make them compatible with user requirements. In addition, the LAW technology program also focused on redesigning components developed previously in order to make them cheaper and easier to manufacture while maintaining or improving upon demonstrated performance. The first phase of developing manufacturing process for carborane was place on contract. An Army Scientific Advisory Panel Ad Hoc Group concluded that the best technical approach for ILAW was selected. Technical efforts on the ILAW concept were completed and the baseline 70mm design was documented. Flight tests were conducted, demonstrating the required system accuracy. Improvements in warhead performance attainable through the use of pressed explosive charges were investigated, and development of improved propellant formulations was continued. Representatives of interested U.S. firms were briefed on the results of the technical effort and given access to the resulting data. This was a new start in Engineering Development. A request for proposals (RFP) for Engineering Development (ED) was prepared and issued to industry. Three firms responded, and their proposals were evaluated. A contract for a 43 month ED effort was awarded the winning firm, General Dynamics, on 27 Feb 76 and ED began. Transfer of in-house developed technology to the contractor was the first step taken. Refinement of the baseline design began, with the contractor evaluating alternative design approaches, materials, and fabrication techniques for the various components of the system. System and man-weapon interface studies were initiated. System and man-weapon interface studies were continued. Fabrication of engineering model hardware for evaluation of alternative approaches by both the contractor and the government began. The Productibility Engineering and Planning (PEP) effort was initiated.
2. FY 1977 Planned Program: Engineering design testing and alternative design approaches will be completed and preferred approaches selected. System design will be frozen and production prototype hardware of the selected configuration will be manufactured. PEP effort will continue.
3. FY 1978 Planned Program: Prototype Qualification Test-Contractor (PQT-C), Prototype Qualification Test-Government (PQT-G) and Operational Test II (OT II) will be conducted, results will be analyzed and necessary changes will be incorporated into the system design. PEP will continue.  
Decrease of funding is due to finalizing the major engineering design effort.

Budget Activity #4 - Tactical Programs

Program Element #6.46.23.A Title Improved Lightweight Antitank Weapon (VIPER)

4. FY 1979 Planned Program: PEP will be completed with the delivery and validation of the Technical Data Package (TDP). Prototype validation testing will be conducted to insure that items produced at full production rates perform as well as the prototypes did. Decrease of funding is due to finalizing the major engineering design effort. Continuation of lowest level effort as specified in paragraph 3 and 4.

5. Program to Completion: Procurement actions coincidental with KDTE will evolve to include initial production facility contract being awarded in FY 1977 and appropriate expansion to 30,000 pound per year production capacity in FY 1978. The system facilities contract will also be awarded during FY 1978. Subsequently, a second source will be qualified. Training necessary to introduce the system into the hands of troops will be conducted and the VIPER will achieve its Initial Operational Capability (IOC) in approximately

6. Major Milestones:

|             |           |
|-------------|-----------|
| DT II/OT II | July 1978 |
| DEVA-IPR    | July 1978 |
| IOC         |           |

FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.26.A

Title: Improved TOW Vehicle (ITV)

Category Advanced Development

Budget Activity #4 - Tactical Programs

RESOURCES (PROJECT LISTING): (\$ in Thousands)

| Project Number | Title                                | FY 1976 | FY 1977 | FY 1977 | FY 1978 | FY 1979 | Additional to Completion | Total Estimated Cost |
|----------------|--------------------------------------|---------|---------|---------|---------|---------|--------------------------|----------------------|
|                | TOTAL FOR PROGRAM ELEMENT Quantities | 4453    | 1990    | 5999    | 822     | 0       | 1000                     | 14264                |
| DF23           | Improved TOW Vehicle                 | 4453    | 1990    | 5999    | 822     | 0       | 1000                     | 14264                |
| Procurement:   |                                      |         |         |         |         |         |                          |                      |
|                | Funds                                | 0       | 0       | 6690    | 5086    | 85081   | 73363                    | 216020               |
|                | Quantities Phase II                  | 0       | 0       | 0       | 550     | 808     | 619                      | 1977                 |

BRIEF DESCRIPTION OF ELEMENT: Program provides for the urgent requirement to place the current TOW antitank missile weapon system mounted on the M113A1 Armored Personnel Carrier under armor protection. Armor protection will greatly increase the combat effectiveness by providing protection from suppressive fires for the missile system and crew.

BASIS FOR FY 1978 RDTE REQUEST: These funds will complete support of prototype vehicle testing and incorporation of necessary engineering changes into the technical data package. Engineering problems encountered during fielding of the system will be investigated, fixes determined and the technical data package will be maintained and revised. These funds will also refurbish and return to US Army inventory six M113A1 vehicles employed during development of the Improved TOW Vehicle Kit.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The decrease in funding is a result of completion of the funding for fabrication of engineering developmental prototypes in FY 1977.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 13   | 0           | 13    |
| (2) Contractor Employees   | 11   | 225         | 236   |
| Total                      | 24   | 225         | 249   |

Budget Activity #4 - Tactical Programs

Program Element #6.46.26.A

Title Improved TOW Vehicle (ITV)

DETAILED BACKGROUND AND DESCRIPTION: Program is designed to provide armor protection for TOW antitank missile and crew. when initially fielded, the TOW antitank missile was mounted on the M113 Armor Personnel Carrier (APC) with no protection against suppressive fires. This two phase program will correct that deficiency. Phase I, the interim system, will be an extremely simple device involving protective ballistic blanket on a metal frame forming a tunnel over the currently fielded TOW mounted on APC. The protective blanket is a minimum cost system quick fix. The follow-on system (Phase II) will be a fully protected weapon station that will give the same level of protection as the M113. Three basic designs were prototyped under this phase. Two concepts placed the missile launcher on a platform which can be elevated above the vehicle to permit the missile to be fired while the vehicle is hidden behind protective cover. The other concept was a more conventional turret concept. A competitive evaluation of the concepts was completed during the first quarter of FY 1977. The launcher on an elevated platform was selected.

RELATED ACTIVITIES: Initial efforts to develop a protected TOW system (TOW under armor) were accomplished under Program Element (PE) 2.37.24.A, Heavy Weapons System, TOW.

WORK PERFORMED BY: Primary contractors are: Northrop Corporation, Anaheim, CA; Emerson Electronics Inc, St Louis, MO and Chrysler Corporation, Detroit, MI. In-house efforts are being performed by US Army Tank Automotive Research and Development Command, Warren, MI and US Army Missile Research and Development Command, Huntsville, AL.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977, FY 1976 and Prior Accomplishments: An interim protective covering (ballistic blanket) over the TOW missile and crew was delivered and released to procurement. Efforts continue toward development of permanent system (Phase II) with design and fabrication of two prototypes each of three distinct concepts with different operational capabilities and degrees of engineering risk. During FY 1976 and 1977 prototypes were completed and entered in a competitive "shootoff" to determine which system is the most cost-effective considering operational capabilities, cost, reliability, and ability to meet the abbreviated time schedule.
2. FY 1977 Program: System entered engineering development in FY 1977, the final year of development for this program. Funding will support the fabrication of six prototypes of the selected concept. Prototypes will be subjected to operational suitability testing in tactical units under actual field conditions. Funding also provides for the engineering design and preparation of a technical data package.



Budget Activity #4 - Tactical Programs

Program Element #6.46.26.A

Title Improved TOW Vehicle (ITV)

3. FY 1978 Planned Program: Testing of six prototypes will be completed and the technical data package will be updated. Production deliveries will begin, and the Engineering surveillance of these activities will be performed in order to incorporate any design changes required into the technical data package. The decrease in funding is a result of completion of the funding for fabrication of engineering developmental prototypes in FY 1977.

4. FY 1979 Planned Program: Not applicable

5. Program to Completion: Not applicable.

6. Major Milestones:

|  | Date         | Estimated RDTE Cost to Reach Events (Cumulative) |
|--|--------------|--|
| a. Development Test/Operational Test I (DT/OT I)<br>(Shootoff of Competitive Prototypes) | Sep - Nov 76 | 7433   |
| b. Award of Production Contract - Limited Procurement - Low Rate<br>Initial Production   | Dec 76       | 7933   |
| c. DT/OT III   | 30 Oct 77    | 13054  |
| d. Development Acceptance In-Process Review  | Jan 78       | 14264  |
| e. Initial Production  | Jan 78       | 14264  |
| f. First Deliveries of ITV Kits  | May 78       | 14264  |



FY 1978 RDTE DESCRIPTIVE SUMMARY

Program Element #6.46.27.A Title Field Artillery Weapons and Ammunition, 8-Inch

Category Engineering Development Budget Activity #4 - Tactical Programs

RESOURCES /PROJECT LISTING/: (\$ in Thousands)

| Project Number | Title<br>TOTAL FOR PROGRAM ELEMENT<br>Quantities | FY 1976<br>4346 | FY 1977<br>1698 | FY 1978<br>4404 | FY 1979<br>1737 | Additional<br>to<br>Completion<br>Continuing | Total<br>Estimated<br>Cost<br>Not Applicable<br>for M110A1E1<br>and infeasible<br>for ammo |
|----------------|--|-----------------|-----------------|-----------------|-----------------|--|--|
|                |  |                 |                 |                 |                 |  |  |
| D389           | 8-Inch Howitzer, M110A1E1                        | 1129            | 781             | 1124            | 230             | 0  | 15483  |
| D666           | Armo, Cannon, 8-Inch                             | 3217            | 917             | 1423            | 1507            | Continuing                                   | Not Applicable   |

BRIEF DESCRIPTION OF ELEMENT: The purpose of this program is to develop an improved 8-Inch Self Propelled (SP) Howitzer Weapon System by providing a new cannon with muzzle brake, improved 8-Inch Rocket Assisted Projectile XM650 and new propelling charge M188E1.

BASIS FOR FY 1978 RDTE REQUEST To provide for M426 (8-Inch Chemical Round) and M509 (8-Inch Improved Conventional Munitions (ICM) Dual Purpose (DP) Round) compatibility testing and qualification (Safety Tests, Range Table Tests, Fuze Tests, Functional Tests) in the M110A1E1 System. To complete muzzle brake testing which provides safe use of top zone capability (Zone 9). To complete XM650 projectile and M188E1 propelling charge development.

BASIS FOR CHANGE IN FY 1978 OVER FY 1977: The reduced scope of testing in FY 1978 over FY 1977 results in decreased funding requirements.

PERSONNEL IMPACT:

The average number of employees supported with requested FY 1978 funds (RDTE and Procurement), is as follows:

|                            | RDTE | PROCUREMENT | TOTAL |
|----------------------------|------|-------------|-------|
| (1) Federal Civ. Employees | 24   | 0           | 24    |
| (2) Contractor Employees   | 35   | 0           | 35    |
| Total                      | 59   | 0           | 59    |
|                            |      |             | 890   |

Budget Activity #4 - Tactical Programs

Program Element #6.46.27.A

Title Field Artillery Weapons and Ammunition, 8-Inch

**DETAILED BACKGROUND AND DESCRIPTION:** The purpose of this program is to develop an improved 8-Inch Self Propelled (SP) Howitzer Weapons System which will increase the range capability of the present 8-Inch System with standard unassisted projectiles and developmental unassisted and rocket assisted projectiles. The program also provides for continued development of an extended range propelling charge M188E1 for the M110A1 Howitzer. The M110A1 Howitzer and M188 charge (Zone 8) were type classified standard in FY 1976. The M188E1 (Zone 9) top zone will add an additional powder increment to provide the required maximum system range capability. The XM650 projectile combines a rocket motor and aerodynamic shape to extend the range beyond the present limit. The improved fragmentation warhead and high explosive filler increase the lethality. The XM650 projectile is ballistically similar to the XM753 nuclear projectile. The M110A1E1 is provided with a long range cannon and muzzle brake that is to be retrofitted on the M110/M107 common chassis.

**RELATED ACTIVITIES:** The XM650 RAP projectile (Project D666) and 8-Inch howitzer improvement efforts (Project D389), P.E. 6.46.27, Field Artillery Weapons and Ammunition, along with XM736 projectile (P.E. 6.46.10, Lethal Chemical Munitions Project DF94), XM753 projectile (P.E. 6.46.03.A, Nuclear Projectile and M422 Modifications Project D663) and XM711 projectile (P.E. 6.36.28.A, Field Artillery Weapons and Ammo Development Project D007) are directly related to upgrading of the 8-Inch Self-Propelled (SP) Howitzer System. There is continuing coordination with the Navy and Marine Corps to avoid any duplication of effort and to maintain as much compatibility as possible. This is especially true with respect to projectiles.

**WORK PERFORMED BY:** In-house efforts are being executed by Product Manager for M110E2 Weapon System, US Army Armament Research & Development Command, (ARRADCOM) at Rock Island, IL, Dover, NJ; and Watervliet, NY; Aberdeen Proving Ground, Aberdeen, MD; Yuma Proving Ground, Yuma, AZ; Dugway Proving Ground, Dugway, UT; and Jefferson Proving Ground, Madison, IN. No contractor is involved in FY 1978 with Project D389 8-Inch Howitzer, M110A1E1. Contractors performing work under Project D666, Ammo, Cannon, 8-Inch, are Norris Industries, Vernon, CA; Ferrulmatic Inc., Peterson, NJ; Haber Inc., Canoga Park, CA.

**PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. FY 1971, FY 1976, and Prior Accomplishments: Feasibility testing of the XM188 propelling charge was conducted in FY 1968 and 1969 with development beginning in FY 1971. Initiation of the effort to improve the 8-Inch Self Propelled Howitzer began in 1969. Initial testing was completed in the early 1970's and the bulk of Development Testing II (DT II) and Operational Testing II (OT II) of the M110E2 Howitzer was conducted during 1974 (testing included fatigue tests, armament tests, ammunition safety tests, firing tables, operational testing and service testing). During Development Test II it was determined that zone 9 of the M188E2 propelling charge exceeded the total momentum transfer limits of the M110E2 Howitzer; therefore, additional zone 9 testing was delayed pending resolution of this momentum problem. Advance Development (AD) of an 8-Inch, high-explosive, rocket assisted projectile began in FY 1970. The program was realigned in FY 1971 and lengthened by a year. The XM650 DT II phase began during FY 1971. DT and OT II of the M110E2 and zone 8 was completed in July 1975. Also in 1975, a low efficiency muzzle brake was selected as the solution to the M110E2 momentum problem. The development of the muzzle brake is being scheduled concurrent with development of the top zone

Budget Activity #4 - Tactical Programs

Program Element #6.46.27.A

Title Field Artillery Weapons and Ammunition, 8-Inch

(Zone 9) of the 8-Inch propelling charge (M188E1) and XM650 High Explosive (HE) Rocket Assisted Projectile (RAP) to attain the full maximum range capability assigned to the Improved 8-Inch Weapon System. A Development Acceptance In-Process Review (DEVA IPR) for the M10E2 and zone 8 of the XM188 propelling charge was held on 16 December 1975. The Improved M10E2 8-Inch SP Howitzer (Zone 8 capability) was type classified Standard as the M110A1, and the XM188 was type classified Standard as the M188 zone 8 Propelling Charge. Type Classification was finalized on 29 March 1976. Development of a zone 9 charge continued through FY 1977. Muzzle brake prototypes, required for future testing were ordered. The muzzle brake confirmatory test and durability test were completed. Final structural analysis on the muzzle brake was completed.

2. FY 1977 Planned Program: M426 8-Inch Chemical simulant filled projectiles required for FY 78 testing, will be manufactured and delivered. Testing of the M110A1E1 (M110A1 with muzzle brake) M188E1 propelling charge (Zone 9) and standard M106 High Explosive (HE) projectile will be conducted. M404 8-Inch Improved Conventional Munitions (ICM) Antipersonnel (AP) projectile range tables and ammunition safety test with the M110A1E1 will be conducted. Productibility Engineering and Planning (PEP) of the XM650 projectile will be completed and the production Technical Data Package (TDP) completed. The XM650 Development Testing II (DT II) and Operational Testing II (OT II) projectiles will be fabricated and testing initiated.

3. FY 1978 Planned Program: M426, 8-Inch Chemical, Projectile and M509, 8-Inch ICM Dual Purpose (DP), projectile compatibility testing (safety tests, range table tests, fuze tests and functional tests) with the M110A1E1 will be conducted. The M110A1E1 (with muzzle brake) will be type classified with the XM650 HE RAP Projectile and the M188E1 (Zone 9) propelling charge during FY 1978. FY 78 funding requirements decrease due to near completion in FY 77 of XM650 and M188E1 efforts.

4. FY 1979 Planned Program: Three Howitzers used for all test activities will be refurbished and turned back into the supply system. M426 and M509 Projectiles will be qualified for use with the M110A1E1. The XM711 high explosive projectile will enter engineering development. The bulk of efforts associated with the M110A1E1 are completed prior to FY 79, thereby, decreasing overall FY 79 funding requirements.

5. Program to Completion: The 8-Inch Self Propelled Howitzer program will be completed in FY 1979; however, the 8-Inch ammunition efforts will continue.